

# E-commerce: A New Concept of Rural Marketing in India

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## Abstract

Digital India through develop the new concept of rural marketing is changing for new life style and fashions for innovative technologies. There are so many rural consumers aware to use in internet facilities in online shopping to other shop purchasing for goods and services. Ecommerce concept not only fasted improve for rural area but also slow going for online purchasing and awareness. I hope that to improve and development of Ecommerce in rural area to create a new job opportunities in future. Rural artisans are use of new business web sites for their own business activities. Other online stores such as Myntra, Jabong and Voonik have also started their deliveries in many villages and towns of the country. The reason is that the department which had been in losses since many years has now collaborated with more than 400 ecommerce websites that also includes big ones like Amazon and Flipkart for goods delivery. There are around 1, 55,000 post offices in India and they are now connected to deliver the goods to customers in otherwise remote areas. There are many ecommerce companies which have reached the villages of the country.

## 1. INTRODUCTION

Rural Markets: From Touch points to Trust points - Winning over India's Aspiring Rural Consumers," rural consumers are particularly aspiring or striving to purchase branded, high quality products. Consequently, businesses in India are optimistic about growth of the country's rural consumer markets, which is expected to be faster than urban consumer markets. The report highlights the better networking among rural consumers and their

tendency to proactively seek information via multitude sources to be better informed while making purchase decisions. Importantly, the wider reach of media and telecommunication services has provided information to India's rural consumers and is influencing their purchase decisions. In line with general trend, rural consumers are evolving towards a broader notion of value provided by products and services which involves aspects of price combined with utility, aesthetics and features, and not just low prices.

E-commerce firms ride Make in India to reach rural markets supporting such schemes help e-commerce expand their merchant base as well as capture the rural market. "SMEs are making good products but funding remains a problem. E-commerce companies are solving this by helping with lending schemes." Last year, start-ups tried to cash in on the Digital India initiative. This year the focus has been on Make in India. Paytm, which has been trying to promote its marketplace, plans to induct around 5,000 Indian manufacturers and sellers this year. The company has launched programmes such as Paytm Force and Paytm Go big partners to identify and train new sellers. "Through our own drive of supporting Make in India products, we have been able to build a relationship with manufacturers from diverse backgrounds, ranging from manufacturers who supply to large global brands to self-help groups out of Maharashtra that provide income to 100 small households by selling their handicrafts/product online Companies are also getting into tie-ups with various ministries. Snapdeal, for example, has partnered with the National Institute of Electronics & Information Technology of the Ministry of Communications and Information Technology to train small and medium businesses (SMBs) on digital marketing.

## **2. GROWTH OF E-COMMERCE IN RURAL INDIA**

Earlier it was thought that ecommerce companies have no reach to the villages of the India. However, in the recent past there have been certain developments in the country, which have connected even the villages to the latest technological trends. The postal service is one system that has the power to connect the whole of the country. It has reached to almost all the villages, even those in the remote locations. The past two years have witnessed dramatic growth for the Indian postal service. The reason is that the department which had been in losses since many years has now collaborated with more than 400 ecommerce websites that also includes big ones like Amazon and Flipkart for goods delivery. There are around 1, 55,000 post offices in India and they are now connected to deliver the goods to customers in otherwise remote areas. There are many ecommerce companies which have reached the villages of the country. They have supported the country in becoming digital through their strong logistics channel. In some locations, these companies use their own delivery services, however, at most of the places third party delivery is used which includes postal service as well. We analyzed the services of various ecommerce companies to know whether they have access to the Indian villages or not. We randomly checked 100 villages' pin codes for a specific product from the biggest players of the ecommerce in the country which are Flipkart, Snapdeal and Amazon.

These are the biggest online retail stores of the country and they have increased their revenue many times with the coverage of cities, towns and now the villages. Other online stores such as Myntra, Jabong and Voonik have also started their deliveries in many villages and towns of the country. However, some of the ecommerce websites have not yet covered the villages. They are still in the process of giving their coverage in the major cities. With the availability of online delivery, the villagers have started gaining benefits from these companies. With more penetration of internet, more people are now able to order their goods online. In addition to the above players, Shopclues cater to 8000 pin codes across small towns and villages. The companies have noticed that there has been high demand of goods such as electronics and utensils from the villages.

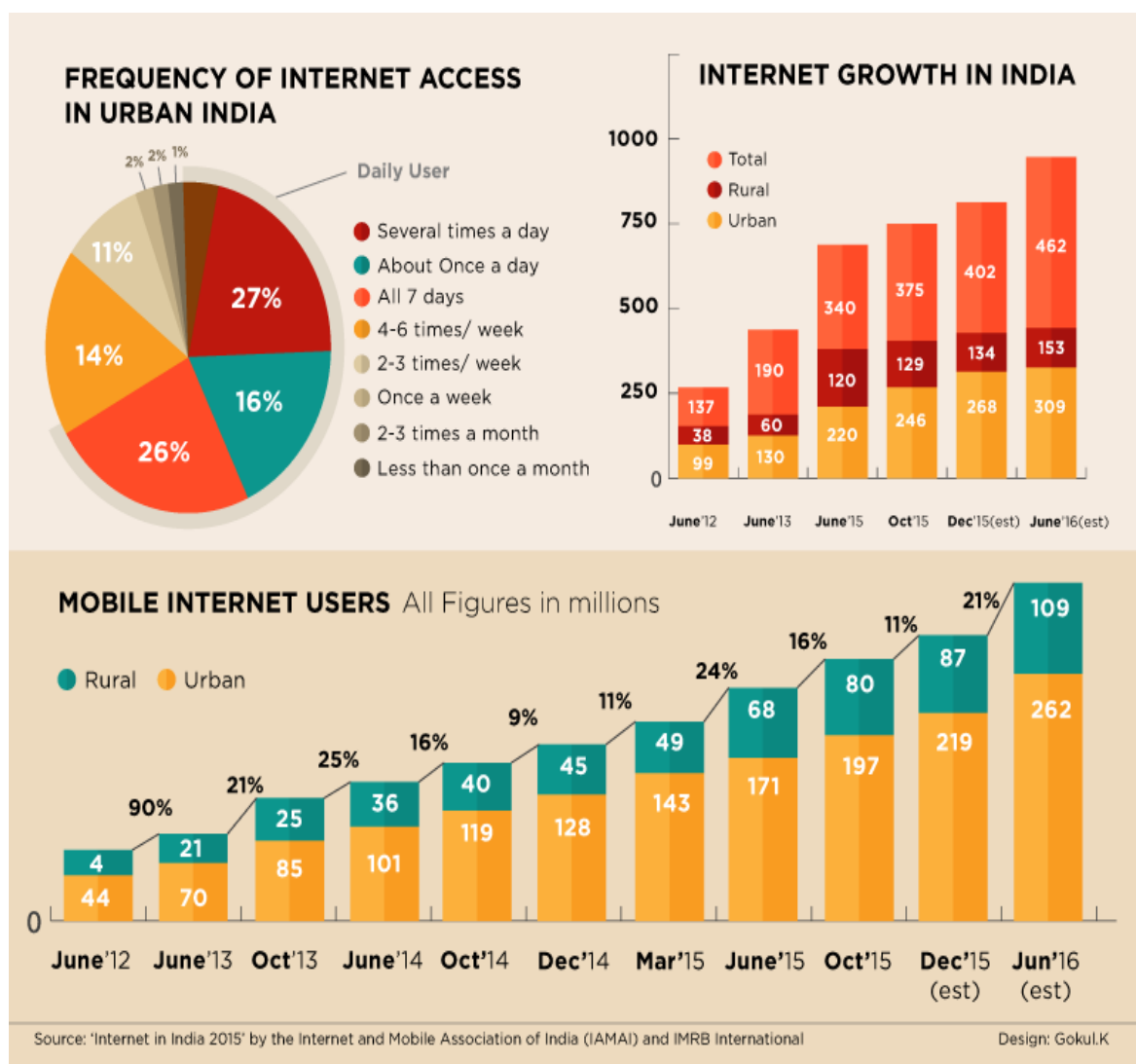
### **3. INDIA TO HAVE THE SECOND-LARGEST INTERNET USER BASE IN THE WORLD REPORT**

India will have the world's second-largest Internet user base by this Year 2015, overtaking the US. This is among the many interesting findings in the 'Internet in India 2015' Report released by the Internet and Mobile Association of India (IAMAI) and IMRB International. According to report, India will have 402 million Internet users by December 2015 and its user base has increased by 49 per cent compared to last year. In October, 317 million Indian users accessed Internet. China has the largest Internet user base, with over 600 million users. It is not surprising anymore that mobile is responsible for a big chunk of this growth. In Urban India, the mobile Internet user base grew by 65 per cent over last year to reach 197 million in October 2015. In Rural India, the mobile Internet user base is expected to reach 87 million by December 2015 and 109 million by June 2016. Ninety-four per cent of users access the Internet through their mobile phones in Urban India. However, 64 per cent also use the desktop or laptop to access the Internet. But 90 per cent of those who use the mobile to access the Internet consider it their primary device for browsing. This growth is in line with industry expectations and will be good news for many consumer-focused tech businesses in sectors ranging from commerce to healthcare and finance. For instance, Founder and CEO of mobile wallet and e-commerce company Paytm, said in his exclusive thought leadership article in the Techs parks 2015 Report – Tech for a Billion: "In the next five years, I expect the country will have banking products or full-fledged banks exclusively using mobile platforms.

India is the ideal laboratory for such innovations, considering India is a young country – 50 per cent of the population is younger than 24 years – and Smartphone's are getting more powerful with each passing day." In an insight that could be very useful for consumer Internet startups, especially for those whose target users are primarily women, the report found that 77 per cent of urban non-working women who access the Internet do so primarily from the mobile device. The top eight metros continue to be the single largest block of users, accounting for 31 per cent of the overall user base. Mumbai and Delhi had the most number of Internet users. Smaller metros, like Jaipur, Surat, and Lucknow, have seen a growth of 60 per cent in monthly active user base (users who have accessed Internet at least once a month) over last year. An unsettling revelation is the gender gap when it

comes to access to Internet. Men account for 71 per cent of Internet users, while women account for just 29 per cent. The gap is slightly lower in urban India, with men accounting for 62 per cent and women 38 per cent. The gap is quite stark in rural India where the men to women Internet user ratio stand at 88:12.

The demographic data in the report also point to some interesting trends. In rural India, 75 per cent of the users fall in the 18–30 years age bracket, while 11 per cent are younger than 18 and 8 per cent are in the 31–45 years group. In Urban India, 32 per cent of monthly active users are college-going students. Online communication, social networking, and entertainment are the top reasons for accessing the Internet. Only 24 per cent of urban users and 5 per cent of rural users accessed the Internet for online shopping.



**Figure 1: Frequency, Growth & Mobile Internet user in India**

Are you a startup working in the technology space and looking to engage in a comprehensive startup ecosystem? Or a mature startup that has developed a successful product



**I. E-commerce Shopping is now emerging in Rural Parts of India:**

In the past few years, India has seen something akin to a revolution in the online shopping market. Many Indians are moving online and they are spending money on stuff. However, in spite of India's massive ecommerce boom, the country's tremendous ecommerce growth has not reached rural Indian where the concept of online shopping is still largely unheard of in some villages. Yet rural Indians are buying things even if they do not know about online retail websites, VISA or MasterCard or even PayPal. Because the majority of Indian population still lives in the rural areas, the true potential of India's online shopping will only be unlocked if Indian retailers can figure out ways in which to reach out to the often underserved rural market that is a fast gaining currency is a viable online market to be reckoned with.

It is not all a lost cause as far as rural Indian ecommerce penetration is concerned, however. There are certain large Indian e-retailers that are slowly making some inroads into the Indian rural market. These include the big players such as Amazon, FlipKart and Snapdeal. On the other hand, there are various Indian start-ups that have solely focused their efforts on the country's rural market such as in three. Players like iPay offering cash payment & fulfillment which also creates opportunity for rural customers to buy products without plastic money online.

**i.) Government has a Role to Play:**

In India, there is a tie-up between ecommerce companies and the Indian government in order to roll out ecommerce services into the rural areas. This is because it might not be quite profitable for ecommerce companies to go it alone in places with poor infrastructure and where they are likely to spend more money on marketing and penetration. These tie-ups smoothen the way for these online ecommerce shopping companies to roll out their services in places that they would ordinarily ignore. The Indian government has also made it easier for foreign ecommerce companies to come here and set up shops in the country, particularly in the rural areas. The Government of India has planned various initiatives to provide and improve the infrastructure in rural areas which can have a multiplier effect in increasing movements of goods, services and thereby improve earnings potential of rural areas subsequently improving consumption. The Union Government plans to build 2.23 lakh km of roads in the rural areas and has proposed a total spending of Rs 27,000 crore (US\$ 4 billion) until March 2017. E-commerce players like Flipkart, Snapdeal, Infibeam and mobile wallet major Paytm have signed Memoranda of Understanding (MoUs) with the government to reach rural areas by connecting with the government's common service centres (CSCs) being setup in villages as part of the 'Digital India' initiative. With the increasing demand for skilled labour, the Indian government plans to train 500 million people by 2022, and is looking out for corporate players and entrepreneurs to help in this venture. Corporate, government, and educational organizations are joining in the effort to train, educate and produce skilled workers.

The Government of India seeks to promote innovation and technology development in the remote rural and tribal areas. The government plans to form a committee

to study various innovations and submit their reports to the concerned Department or Ministry. The programme called the 'NavKalpanaKosh' aims to improve rural areas at various levels, such as governance, agriculture and hygiene.

Banks are working to set up rural ATMs, which will dispense smaller denomination currency notes. "We have encouraged banks to find a solution for bringing in rural ATMs... banks will have to find an appropriate technology solution for a different type of ATM to care for the needs of the rural people," as per Deputy Governor, Reserve Bank of India (RBI). Confederation of Indian Industry (CII), an association of Indian businesses, plans to set up a centre of excellence for start-ups in smaller towns across the country to help create a conducive environment for their incubation and growth.

### ii) **The Role of Indian Postal Services:**

In the urban areas of India especially the big cities such as Mumbai, New Delhi or Bangalore, ecommerce companies can simply charge low and competitive shipping costs and deliver the products themselves. However, in the remote rural villages in India, this business model is not necessarily feasible. It would amount to very high shipping costs that either drive down the margins or drive away the customers. For many of these companies working hard to penetrate the rural Indian market, the Indian postal service has come to the rescue. Traditionally reliable and cheap, the Indian postal service infuses the much-needed reliability and competitiveness when it comes to shipping ecommerce products to end consumers in the remote villages in rural India.

Global e-retailer Amazon has found great uses for India's postal infrastructure in its ecommerce deliveries. Most of Amazon's deliveries in rural India are done via India-Post which has a ubiquitous reach in the country. It is important to note that a whopping 89.7% of post offices in India are situated in rural India which gives ecommerce companies a vast infrastructural network to work with. Thanks to these new opportunities in ecommerce, India-Post has also increased its reliability and quality of service substantially. For example, buyers are able to track their consignment sent via India-Post online and they are able to send stuff all over India.

### iii) **Required Improvements in the Indian E-commerce Landscape:**

A lot of challenges facing ecommerce growth in rural India are infrastructure-related. Thus, when addressing the problem of growth in rural India, it is important to bring in the government and infrastructure providers into the discussion. There is a lot that needs to be done in order to boost rural ecommerce growth. These include the following:

- Making strategic investments in internet/broadband penetration in rural India. The government can, for example, provide strategic incentives to internet providers in rural India.
- Develop strategies and roadmap for promoting ecommerce growth in rural India. This should be a multi-stakeholder effort incorporating the Indian government, ecommerce companies, local state governments and infrastructure providers. Even consumer advocacy groups should be involved in the process.

- Using available resources and data in order to promote policy development and initiatives to boost rural ecommerce. For example, the use of the India-Post logistical infrastructure.

One of the initiatives that have taken off in the recent years is the campaign to connect every village in rural India with broadband which is spearheaded by BSNL. So far, more than 600 districts have been covered.

## **II. Customer Order Delivery (COD)—A Fantasy in Rural Areas:**

Talking of product delivery, ecommerce companies struggle to reach the unreachable in many remote areas including many states in Northeast India due to poor transportation facility. Moreover with more than half of the online sales being dependent on COD and unavailability of third party logistics services in rural areas, online retailers in order to satisfy complete their Pan-India network, use private courier services which then doesn't allow companies to accept COD – the only successor of Indian ecommerce industry.

Payments are the biggest challenge while selling in Tier 2 and Tier 3 cities, believes CEO at Real Shoppe. "A majority of population living outside urban areas do not have any bank cards to pay with, and those who do have, are not very comfortable using them. So card payments in those areas aren't going to generate much traction unless and until you innovate payments in such a way where you the money beforehand." India Post however, is one such delivery service that promises to deliver Pan-India and that too on COD. But how efficient their services are, is the real question here. Despite having a huge coverage the service is not the preferred service by the ecommerce players. So there are several logistics, operational and technological challenges when it comes to reaching the consumers living in rural areas.

## **4. E-COMMERCE INDUSTRY AS A CAREER OPTION: AN OVERVIEW**

India's e-commerce market grew at a staggering 88% in 2013 to \$16 billion, riding on booming online retail trends and defying slower economic growth and spiraling inflation, according to a survey by industry body ASSOCHAM. It is a rapidly expanding sector, throwing up thousands of new job opportunities every year. Senior VPHR, Jabong.com informs that the e-commerce industry has grown by leaps and bounds in the past few years. "As per a CRISIL research report, ecommerce in India is estimated to grow at 50-55% annually for the next three years and is touted to become an Rs 50,000-crore industry by 2016," he shares. The e-commerce industry is growing significantly in India and expected to add tons of jobs in the years to come, COO, Digital Quotient. "Owing to the rapidly changing consumer behavior and shopping patterns, one can expect a continued growth in the coming years. He explains the job market in this relatively new industry seems to be flourishing like no other industry. This is an ideal industry for people who are fast-paced, fuelled by passion, highly creative and for whom comfort is not a priority. I believe for creative-enthusiasts and geeks, it is fascinating to work in ecommerce. Moreover, there is a positive growth outlook for this sector. The hiring activities are expected to grow by over 30% in this sector and may help create up to 50,000 employment opportunities in the next

two to three years. "Tier-1 B.Tech and MBA grads mostly join us from IITs and IIMs. As per a study by Nielsen, today, almost one-fourth of MBA students from across India's top tier business schools, including the IIMs, said they would prefer working for the fledgling e-commerce sector, over traditional favorites like consulting and financial services jobs," he shares.

Further discussing the kind of career prospects and opportunities professionals can look at in this industry, and the hottest jobs available, CEO and co-founder, ixigo.com avers, "The e-commerce industry is currently witnessing an upsurge in growth and this is the right time for aspiring individuals to turn to this industry. While there is always a demand for solid web app developers and quality experts; content writers, graphic designers and digital marketers also have a huge role to play. "The industry is growing at a rapid pace. And this means that the growth opportunities in this industry would be ample too. This has given a lot of employees the exposure and growth they would have found impossible to achieve in more established companies where hierarchy and experience take precedence over talent." "E-commerce offers a dynamic work environment. It exposes a professional to all the powerful core essentials of a business functioning like product marketing, supply chain, pricing and profit management, customer acquisition, cross selling, up-selling, customer service and much more. Not many jobs present that holistic picture. Globally, the sector is booming and is expected to grow to \$675 billion by 2016." Moreover, not only does the e-commerce industry have the hottest jobs in present times, but also the coolest work environment.

E-commerce companies typically exhibit an informal working culture, with lower levels of hierarchy in comparison to traditional industries and MNCs. "E-commerce is a fast-paced industry, which rewards those companies that are able to rapidly pivot to exploit changing trends. Thus, prospective candidates must display great communication skills, flexibility and enthusiasm for the constant innovativeness that is required in this industry," he explains.

## 5. CHALLENGES WHILE REACHING THE RURAL AREAS

Ecommerce companies face a number of operational hurdles, especially in rural areas—given the poor infrastructure available in those parts of the country. The low literacy rate in the country is another problem for the growth of ecommerce, as even the educated people in rural areas are not able to handle cyber technology. "In recent years, rural markets have acquired significance, as the overall growth of the Indian economy has resulted in the substantial increase in the purchasing power of the rural communities. In fact estimates show rural markets are growing much faster than urban markets. But there are a number of factors hindering the growth of ecommerce in the country, biggest of which are low Internet penetration, payments and distribution logistics."

## 6. CONCLUSION

Due to the development of information technology and internet, the world market has converted toward e-marketing and business. But the low literacy rate in the country is



the basic hurdle for the rapid growth of e-commerce; even the educated people are not able to handle I-phone, laptop and desktop with cyber technology. Many players of e-commerce still failed to reach many remote areas including the states in India. The benefit of e-commerce is available only to the capital district of the state except tribal areas. This may be due to the transportation facility and courier services are rarely available except speed post which is also facing many problems to reach the unreachable. Unavailability of 3G service and broadband is still a question in many rural areas of the country for the development of e-commerce. There are so many rural consumers aware to use in internet facilities in online shopping to other shop purchasing for goods and services. Ecommerce concept not only fasted improve for rural area but also slow going for online purchasing and awareness. I hope that to improve and development of Ecommerce in rural area to create a new job opportunities in future.

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# Compare The Agility Ability Of Female Soccer Players Of Tripura

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Keywords	Agility, Rhythmic Ability, Ninety Female Subjects, Sub-Division, District, Tripura State Soccer Player				

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## Abstract

*The purpose of the study was to compare the agility ability of female soccer players of Tripura state at different level. The subjects for the study were from the state of Tripura. A total of ninety female subjects were selected. Thirty subjects were selected from each level i.e. Sub-Division, District and State, with the help of expert and scholar's personal understanding. The agility ability was measured by using 4 x 10 m shuttle run. The score was recorded to the nearest tenth of a second. To compare the agility ability of female soccer players of Tripura state at different level the mean, standard deviation and analysis of variance was applied at 0.05 level of significance. In the present study mean and standard deviation of agility ability Sub-Division  $10.97 \pm 1.12$ , District  $11.00 \pm 0.92$  State  $11.24 \pm 1.36$  and Total  $11.07 \pm 1.14$  and no significant difference was found in case of agility ability.*

## 1. INTRODUCTION

During the modern times, sport has become a part and parcel of our culture. It is being influenced and does influence all of our social institutions including education, economics, arts, politics, mass communication and international diplomacy- its scope is awesome. Today sports have become mass participation; it is being adopted as fashion by some. It attracts the mass either for recreation or physical fitness, or as a profession. Women's association football is the most prominent team sports for women in the many countries, and one of the few women's team sports with professional leagues. Physical fitness: "A successful adaptation to the stressors of one's lifestyle". The insufficient training of co-ordinative abilities limits the performance ability especially at higher level. On contrary, better developed coordinative abilities provides an effective learning, stabilization and variation in technique and successful execution in game situation. The quality of performance of all fundamental mechanical skills, the system, flow, accuracy, amplitude etc

are improved by coordinative abilities. It helps in developing very fine extra credible skill. In fact, any kind of movement training depends on coordinative abilities to a great extent. Although Motor Fitness is most often used synonymously with the physical fitness by the coaches but, it is very important for the physical education students to understand the basic difference between physical fitness and motor fitness. Physical fitness is used to denote the five basic fitness components, i.e muscular strength, muscular endurance, cardiovascular endurance, freedom from obesity and flexibility whereas, skill related physical fitness is more comprehensive term which include all the ten fitness components including additional five motor components, ie., power, speed, agility, balance and reaction time which are important mainly for success in sports. Agility is the ability to change directions quickly and control body movements. The speed with which an individual may change his body positions or fatness in changing directions while moving is known as agility.

## 2. STATEMENT OF THE PROBLEM

The purpose of the study was to compare the agility abilities of female soccer players of Tripura state at different levels.

## 3. OBJECTIVES OF THE STUDY

To compare the agility ability of female soccer players of Tripura state at different levels. (Sub-Division, District and State)

## 4. HYPOTHESIS

On the basis of the literature reviewed, expert opinion and scholar's own understanding the problem it was hypothesized that there will be no significant difference between selected agility ability of the soccer female players of Tripura State at different levels.

## 5. SAMPLE & CRITERION MEASURE

The subjects for this study were from the state of Tripura. A total of ninety female subjects were selected. Thirty subjects were selected from each level i.e. Sub-Division, District and State. Agility was measured by using 4 x 10 m shuttle run. The score was recorded to the nearest tenth of a second.

## 6. RESULTS

Result of the study has been presented in tabular and graphical form for the component of agility ability where \*\* shows to be significant at 0.05 level.

**Table-1: Descriptive statistics of Female Soccer players (Sub-division, District and State) of Tripura State in relation to Speed Ability**

		N	Mean	S.D.
Explosive strength	Sub-Division	30	10.97	1.12
	District	30	11.00	0.92
	State	30	11.24	1.36
	Total	90	11.07	1.14

Table- 1 clearly indicates the mean and standard deviation of female Soccer players (Sub-Division, District and State) in relation to agility ability. The observe mean and standard deviation of agility ability Sub-Division  $10.97 \pm 1.12$ , District  $11.00 \pm 0.92$  State  $11.24 \pm 1.36$  and Total  $11.07 \pm 1.14$ .

**Table-2: Analysis of variance of Female Soccer players belonging Sub-division, District and State Level in relation to agility**

	Sum of Squares	df	Mean Square	F
Between Groups	1.342	2	.671	.503
Within Groups	116.039	87	1.334	
Total	117.381	89		

Tab. F.05 (2, 87) = 3.09

It appears from the Table-8 that the computed value of F (.503) among different level of female Soccer players of Tripura State (i.e. Sub-division, District and State ) in relation to rhythmic ability was less than the tabulated (3.09), F at .05 level . Therefore null hypothesis among different level of female Soccer players of Tripura State (i.e Sub-division, District and State) in relation to rhythmic ability was accepted at 0.05 level.

## 7. CONCLUSION

According to the results of the study no significant difference was found between Sub-division, District and State level of female soccer players in Tripura. As soccer is becoming 'total football' which requires fast nature of the game. Thus at every level agility is very important. Finally there was no significant difference at Sub-division, District and State level of female soccer players in Tripura. In the light of findings of the study, the hypothesis that there shall not be any significant differences between means of agility ability of female Soccer players of Tripura State at Different Levels (Sub-division, District and State,) was not accepted. Conclusively no significant difference was found in case of agility ability.

## 8. RECOMMENDATIONS

In light of conclusions drawn, the following recommendations were made:

- Studies can be conducted on national level female soccer players receiving specialized exercise training so that future training is supported by scientific data for excellence in specific fields.
- Studies on fatigue resulting from different types of exercises can be carried out and its metabolic basis worked out. Such studies would be of great applied value in enhancing players' performance and would safeguard their health.
- India is a vast country both from the geographical as well as the genetic lineage point of view. Therefore, to exploit the potential of the masses, sport research should be conducted in different climatic regions and on populations of different genetic origins.



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# Investigation Of Mechanical And Tribological Behaviour of WS<sub>2</sub> & ZrO<sub>2</sub> Filled Epoxy Composites

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<b>Keywords</b>	Epoxy, Composites, WS <sub>2</sub> and ZrO <sub>2</sub> fillers, Mechanical Properties, Stir Casting Technique, Tribology, Taguchi Technique, SEM				

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## Abstract

Now-a-days polymer matrix composites find extensive applications due to their several advantages like high wear resistance, strength-to-weight ratio, stiffness-to-weight ratio and low cost. Particulate fillers can be added in these polymer matrix composites to enhance the performance of composites. The present work is an attempt to prepare and study the mechanical, tribological and morphological behavior of WS<sub>2</sub> and ZrO<sub>2</sub> reinforced epoxy composite, with different concentration of particulate fillers. The epoxy AW-106 and hardener HV 953U were used and the specimens were prepared by stir casting technique. The mechanical testing of samples was done as per ASTM standards. The wear rate based on Taguchi's design of experiment considering parameters filler content, normal load, sliding velocity and time was computed using Pin-On-Disc tribometer. The mechanical results turned out to be significantly increased by addition of WS<sub>2</sub> and ZrO<sub>2</sub> fillers. The optimum mechanical properties viz. density, hardness, tensile strength, flexural strength and impact strength are obtained at 12.5 wt. % ZrO<sub>2</sub> and 4.0 wt. % WS<sub>2</sub>. From the experimental investigation, it was found that time has the most significant effect followed by sliding velocity, filler content and normal load on specific wear rate. Wear mechanisms of worn surfaces were analyzed through Scanning Electron Microscopy.

## 1. INTRODUCTION

In recent years, polymeric based composite materials are finding increasing use in many applications due to their strength, lightness, ease of processing, high wear resistance and low-cost. Properties of composites are not only dependent on the properties of their constituent materials, but also their distribution and the interaction among them. They are widely used in many industrial applications such as structural, aerospace, automobile and chemical. Addition of fillers in polymeric composite enhances mechanical, tribological and other properties and also there is a cost reduction in terms of consumption of resin material. The critical and final selection of filler primarily depends upon the requirements of the end products. A literature survey indicated that the addition of tungsten disulphide as a filler with 4 microns size is thoroughly mixed with epoxy resin in seven different volume percentages by simple mechanical stirring. The investigation studied by J. S. Sidhu et. al. [1] led to the conclusion that Polymer composites suitable for Engineering components subjected to wearing environments can be successfully prepared by filling in micro  $WS_2$ . Research work in the field of mechanical properties of the polymer dominated by Srivastava et. al. [2] showed that the fracture toughness of epoxy resin could be improved by fly ash particles as fillers. The fillers affect the tensile properties according to their packing characteristics, size and interfacial bonding. The maximum volumetric packing fraction of filler reflects the size distribution and shape of the particles. Lingaraj et. al. [3] studied the mechanical properties of fiber-reinforced composite, which showed improvement by the inclusion of nanoparticles. Addition of 1%wt. of silica showed improvement in impact strength, tensile strength, Barcol hardness and reduction in wear rate. Ricardo Baptista et. al. [4] studied the effect of the incorporation of different amounts of graphite filler on the mechanical properties of epoxy resin and of carbon fiber reinforced epoxy composites. Graphite-reinforced epoxy resin attained results show that 7.5, 10 and 11.5 wt.-%-graphite results in the best balance of mechanical (modulus, strength, strain) properties and that the incorporation of graphite as matrix filler in carbon fiber reinforced epoxy results in improvement on mechanical properties, up to a limiting value. S. Pichi Reddy et. al. [5] investigated tensile and flexural behavior of fly ash reinforced glass fiber epoxy composites with different weight percent of fly ash. The results showed that with increase of fly ash better tensile strength is obtained and flexural strength decreases, reaches a maximum value and again decreases with the addition of fly ash in the epoxy matrix. Manoj Singla and Vikas Chawla [6] investigated the Mechanical Properties of Epoxy Resin – Fly Ash Composite with the addition of fly ash and then by reinforcing glass fiber. With the addition of fly-ash in epoxy resin –fly-ash composite the compressive strength has been found to increase with increase in fly ash particles and after reinforcing glass fiber both compressive & impact strength has been increased. J.M. Wernik, S.A. Meguid [7] investigated the mechanical properties of carbon nanotube reinforced epoxy adhesives experimentally. The experimental observations indicate a critical carbon nanotube concentration in the vicinity of 1.5wt% that results in the largest improvements in the mechanical properties. At concentrations exceeding this critical value, the properties begin to degrade, in some cases,

to levels below that of the pure epoxy. The process of wear may be variously defined but most generally it is quantitatively measured in terms of the mass, or volume, loss from a sliding or eroding contact investigated by B J Briscoe and S K Sinha [8]. Good tribological properties can be obtained for polymers filled with nano scale fillers and micro scale particles. The friction and wear resistance of these composites is found to increase with increasing filler concentration. The change of wear resistance and friction coefficient depends on the size and volume fraction of the Nano filling materials. It is also possible to use multi-functional fillers to develop high performance composite materials which can be not achieved by using single filler studied by Ayman A. Alyet. al. [9]. Wear of polymer is generally accelerated by heating during friction. Witold Brostow et. al. [10] showed that carbon nano tubes added to polyamide matrix improve the properties such as the increase of the initial decomposition temperature, increase of the tensile strength and modulus of elasticity, tribological properties are improved reducing penetration depth. P. Arivalagan et. al. [11] studied that the inclusion of cenosphere as filler materials in carbon epoxy composites will increase the wear resistance of the composite greatly. Bhadrabasa Revappa Raju et. al. [12] investigated that in abrasion mode, as the filler loading increases the wear volume decreases and increased with increasing abrading distance. The excellent wear resistance was obtained for  $Al_2O_3$  filled G-E composites. Siddesh Kumar N G [13] found that the addition of  $Al_2O_3$  and  $MoS_2$  reinforcement increases the wear resistance of the composite. The wear rate decreases with the increase in the percentage by weight of fillers. As the sliding speed increases the wear rate decreases initially and then increases. The wear rate increases with increase in load and sliding distance. L. Chang, Z. Zhang, H. Zhang [14] stated that solid lubricants e.g. PTFE and graphite flakes were proved to be generally helpful on developing a continuous transfer film the two counter parts and accordingly reduced the co-efficient of friction. M. Sudheer et. al. [15] analyzed that the strength properties of composites were slightly reduced after whisker addition. However, incorporation of solid lubricant as secondary filler resulted in improvement of both mechanical and tribological properties of composites. In view of the above, this research article reports a study on mechanical and tribological performance of Epoxy (AW-106+HV-953U) with particulates  $WS_2$  and  $ZrO_2$  as fillers.

## 2. EXPERIMENTAL DETAILS

### 2.1 Materials and Methods

Epoxy AW 106 resin, chemically belonging to the “epoxide” family is used as the matrix material in this present research procured from local dealer. Its common name is Bisphenol-A-Diglycidyl-Ether. The low temperature curing epoxy resin (Araldite AW 106) and the corresponding hardener (HV 953 U) figure 1 are mixed in a ratio of 100:90 by volume as recommended.



Figure 1: Silicon spray, Hardener and Epoxy resin



Tungsten disulfide (99.9%, density 4.2 gm./cm<sup>3</sup>) with average size 4μm provided by Sajan Overseas, Vatva, GIDC (G.S.) and Zirconium dioxide (97%) supplied by Otto chemie Pvt. Ltd., Mumbai were chosen as reinforcing material in epoxy resin to prepare the composites.

### 2.1.1 Specimen preparation for mechanical properties

Stir casting technique was employed to fabricate the composites. The required quantities of fillers WS<sub>2</sub> and ZrO<sub>2</sub> were stirred gently in the epoxy resin taking care that no air bubble is entrapped inside the solution. These ingredients are thoroughly mixed in a beaker. The mixture is then slowly poured into the metallic mold cavity (figure 2) which is coated with uniform thin film of silicone-releasing agent for its excellent releasing characteristics. The composites are cast so as to get the specimens of 200mm×25mm×8mm as in figure 3. The mold is placed in an electric oven and heated at a constant temperature of 100°C for about 45 minutes. After the mold is taken out the samples are released. Composites of six different compositions for mechanical testing are made as shown in the table 1.



Figure 2: Metallic die cavity

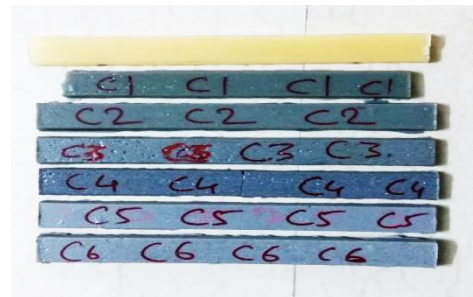


Figure 3: Specimens prepared by stir casting

Table 1: List of particulate filled composites

Material Designation	Epoxy (Wt. %)	WS <sub>2</sub> (Wt. %)	ZrO <sub>2</sub> (Wt. %)
C0	100	0	0
C1	95.5	2	2.5
C2	92.5	2.5	5
C3	89.5	3	7.5
C4	86.5	3.5	10
C5	83.5	4	12.5
C6	80.5	4.5	15

### 2.1.2 Mechanical Tests

The density of the composites was determined by using a weight Mettle balance. The test was performed as per ASTM D792 standards. The dimensions of the specimen used were 20mm×20mm. Hardness (Shore-D) of the samples was measured as per ASTM D2240 at 23±2° C. Five readings at different locations were noted and average value is reported. Tensile strength was measured using a Universal testing machine in accordance with the ASTM D-638. The dimensions of the specimen were 100.0mm×25.0mm×8.44mm. Two samples were tested in each set and the average value was reported.

Flexural test were performed using 3- point bending method according to ASTM D790 standard procedure. It is measured in terms of stress. The flexural strength (*F.S.*) of any composite specimen is determined using the following equation:

$$F. S. = \frac{3PL}{2bt^2}$$

Where, *L* is the span length of the sample. *P* is the load applied; *b* and *t* are the width and thickness of the specimen respectively.

Izod impact testing is an ASTM standard method of determining the impact resistance of materials. The impact strength was determined by using Izod Impact Tester and the tests were done as per ASTM D256 standards. The dimensions of the specimen used were 63.5mm×12.7mm×8.4mm.

## 2.2 Specimen preparation for tribological properties

The procedure similar to preparation of composite specimen for mechanical testing is followed here. The die used for preparation of specimens for tribological properties is shown in figure 4 from which specimens of 12mm diameter and 61mm length are obtained (figure 5). Composites of four different compositions are made as shown in the table 2.

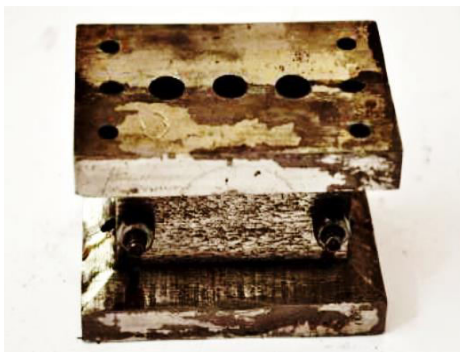


Figure 4: Metallic die cavity



Figure 5: Specimens prepared by stir casting

Table 2: List of particulate filled composites

Material Designation	Epoxy (Wt. %)	WS <sub>2</sub> (Wt. %)	ZrO <sub>2</sub> (Wt. %)
C1	92.5	2.5	5
C2	89.5	3	7.5
C3	86.5	3.5	10
C4	83.5	4	12.5

### 2.2.1 Dry Sliding Wear Test

Under dry sliding condition, wear tests are carried out on pin-on-disc type friction and wear monitoring equipment supplied by DUCOM as per ASTM 99 to evaluate performance of composite. Figure 6 shows the pin-on-disc set up. The specimen surface comes in contact with hardened steel disc (EN 31). The disc was rotated and the specimen was held stationary while a normal force was applied through a lever mechanism. The series of tests were

conducted by selecting test duration, load and velocity. Loss of material from the composite surface was measured using a precision electronic balance with least count of 0.001gms. Following equations are used for calculation of wear rate.

- i. Volume wear =  $\Delta M / \rho$
- ii. Sliding Distance (SD) =  $2\pi r N t$
- iii. Specific wear rate =  $\Delta M / SD \rho F$

Where,

$\Delta M$ = Loss in weight,  $r$  = radius of wear track = 60mm,  $N$ = speed of disc in RPM,  $t$  = time in minutes,  $\rho$ = density in  $\text{gm/cm}^3$ ,  $F$ = Normal load in Newton.



**Figure 6: Pin-On-Disc Set up**

### **2.2.2 Taguch's Design of Experiment**

For modeling and analyzing the influence of control factors on performance output, Taguchi's Design of experiment is a powerful analysis tool. In the design of experiment the most important stage lies in the selection of the control factors. The wear tests were carried out under operating conditions viz. Filler content, Normal Load, Sliding Velocity and in accordance with L16 orthogonal array. The experimental observations are transformed into signal-to-noise (S/N) ratios. The S/N ratio for minimum wear rate coming under smaller is better characteristic, which can be calculated as logarithmic transformation of the loss function as shown below-

Smaller is the better characteristic:

$$S/N = -10 \log 1/n (\sum y^2)$$

Where  $n$  is the number of observations, and  $y$  is the observed data. "Smaller is better" characteristic, with the above S/N ratio transformation, is suitable for minimization of wear rate.

## **3 RESULT AND DISCUSSION**

### **3.1 Mechanical Properties**

Filler content was varied to investigate its effect on mechanical properties.

#### **I. Density:**

The density test results for various specimens which were prepared with WS<sub>2</sub> and ZrO<sub>2</sub> fillers with different volume fractions are plotted in figure 7. The density is taken randomly throughout the length of the specimen. The density of bare polymer is 1.095g/cm<sup>3</sup>. With the increase in percentages of both the fillers, densities of the composite increases gradually till combination (C4), after which it starts decreasing. The maximum density is 1.599g/cm<sup>3</sup> at C4.

The density of composite is decided by the relative proportions of matrix and reinforcing material and it is one of the important factors which determine the properties of the composites.

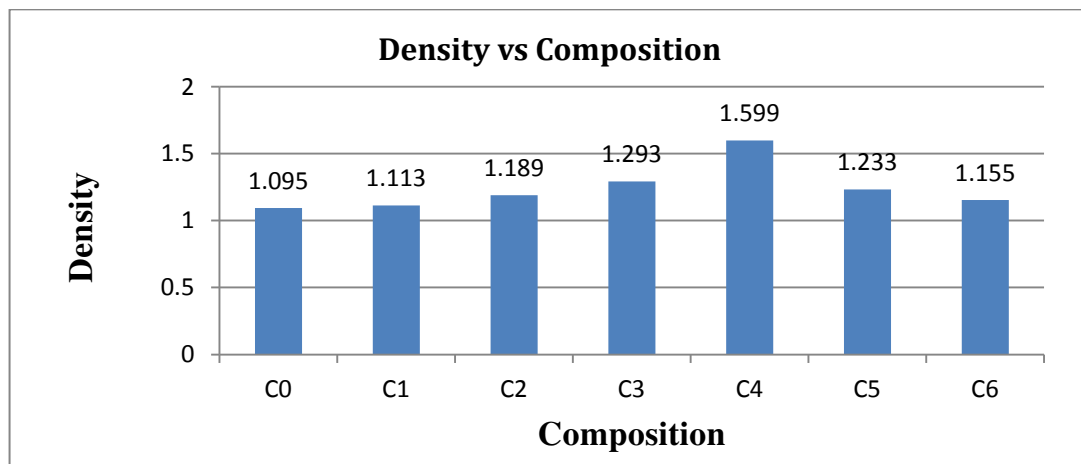


Figure 7: Results of Density test

## II. Hardness:

The graph figure 8 shows the hardness value of bare polymer is 70 and as the percentage of fillers WS<sub>2</sub> and ZrO<sub>2</sub> is increased in the resin the hardness increases gradually till C3. At C3 combination, the hardness reaches its highest value 76 as compared to bare polymer and then starts the downward trend. This downward trend is important as the hardness goes on decreasing in spite of addition of fillers. It determines the filler limiting concentration above which material becomes unusable.

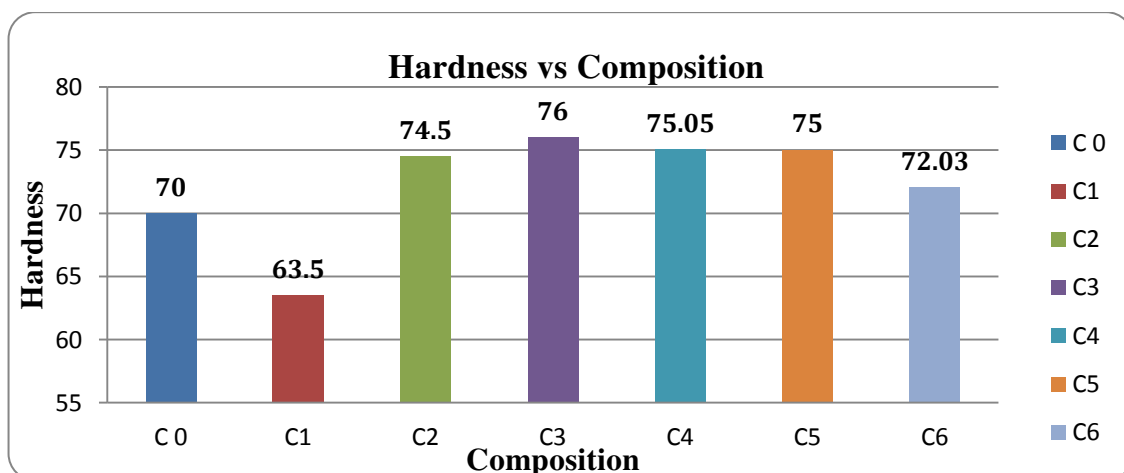


Figure 8: Results of Shore-D test



### III. Tensile strength:

Figure 9 shows the effect of WS<sub>2</sub> and ZrO<sub>2</sub> particulates on the tensile strength. The tensile strength of bare polymer is 32 MPa and this value distinctly increases as filler volume percent goes on increasing. The maximum tensile strength is at C5 which is 36.82 MPa. However, as filler material occupies relatively high volume percent, the property of mechanically mixed composites tend to decrease.

The reason behind this decrease in strength is due to weak interface between matrix and filler material. Addition of fillers in resin leads to higher filler to filler contact because of which there is a poor interfacial bonding between matrix and filler. This poor interfacial bonding doesn't allow the effective load transfer which leads to failure quickly.

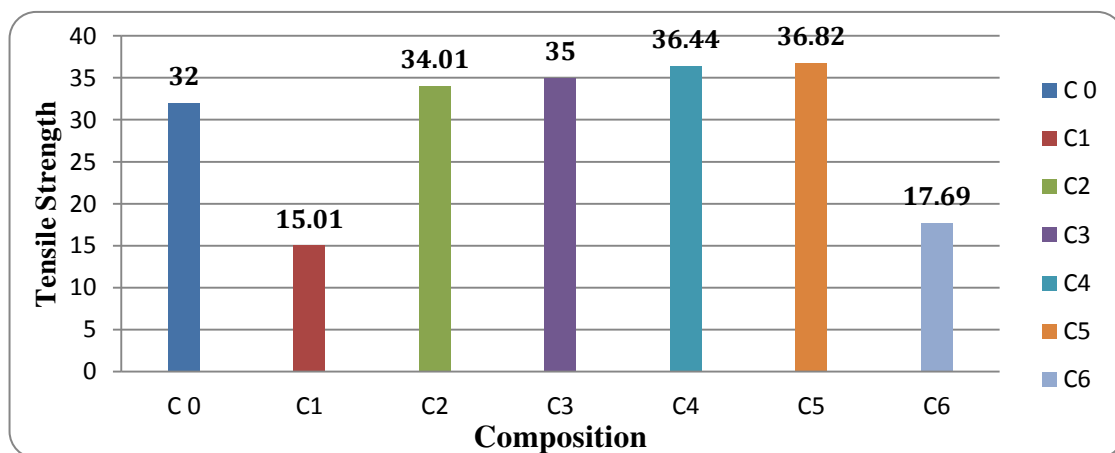


Figure 9: Results of Tensile Test

### IV. Flexural Strength:

Similar results were obtained for flexural test. Figure 10 shows variation in flexural strength. The flexural strength of bare polymer is 41 MPa. The addition of ZrO<sub>2</sub> and WS<sub>2</sub> (up to 15% and 4.5% resp.) into the polymer matrix resulted in growth in flexural strength from 41 to 58.49 MPa. The largest increase of approximately 42% was observed at concentration of 15 wt. % ZrO<sub>2</sub> and 4.5 wt. % WS<sub>2</sub>. The decrease in C2 might be due to the improper dispersion of fillers or due to presence of voids in the composite due to Stir casting technique.

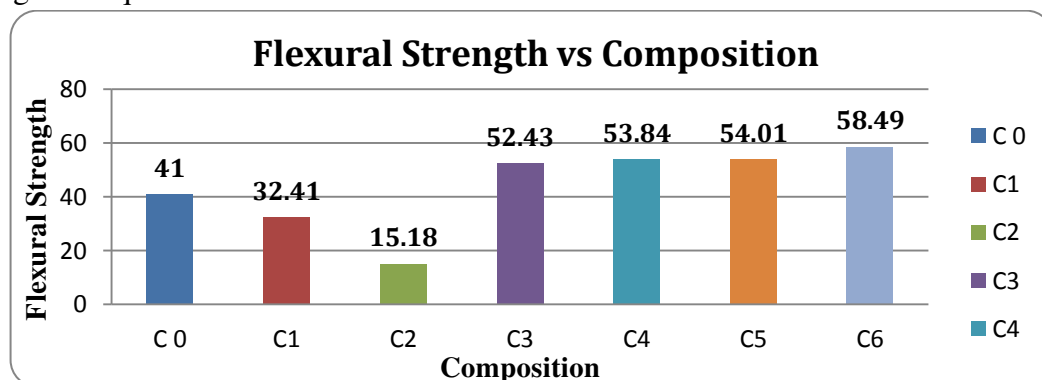
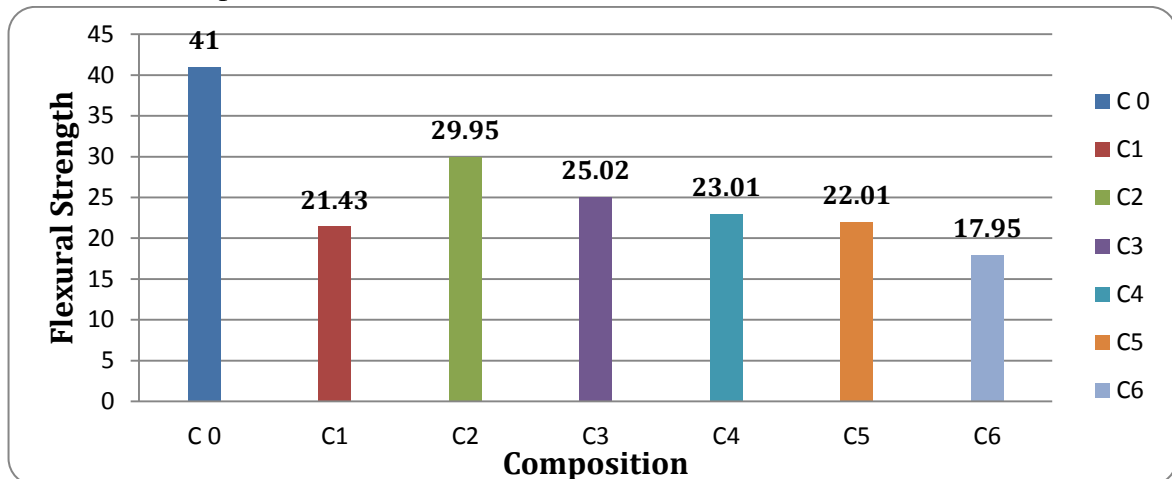


Figure 10: Results of Flexural Test

## V. Impact strength:

From the graph figure 11, it is clear that the composite containing no filler i.e. the bare composite shows highest impact strength 41 J/m. The addition of fillers  $ZrO_2$  and  $WS_2$  show a decreasing trend in the impact strength. However, composite with 5.0 wt. %  $ZrO_2$  and 2.5 wt. %  $WS_2$  improved the impact strength of epoxy significantly, achieving a 38% improvement compared to C3 composite. Additional inclusion of fillers resulted in strength reduction of composites.



**Figure 11: Results of Izod impact Test**

The experimental results above revealed that addition of  $ZrO_2$  and  $WS_2$  fillers in epoxy show a noticeable effect on mechanical properties of the composites. In addition, at approximately C6 all the properties begin to display insensitivity to further increase in filler content seeming to suggest that higher concentrations above C5 may in fact cause degradation in the properties.

## 3.2 Tribological Properties

Since four parameters and four levels are identified (table 3) according to array selector “L16”, orthogonal array is selected. The wear of polymer composites with varying filler content, test duration, normal load and sliding velocity are reported in table 4. The S/N ratios obtained for wear rate are presented in table 5. The analysis shows that most influencing parameter on wear rate is time followed by velocity, filler content and normal load. Based on tabulated results it is observed that for the given time, wear rate of the composites decreases with increasing filler content that means at a given time of contact the wear rate is sensitive to filler content and velocity.

**Table 3: Process variables and their levels**

Parameters	Levels			
	1	2	3	4
A:Sliding velocity (m/sec)	2.512	5.024	7.536	10.048
B:Normal Load (N)	39.24	49.05	58.86	68.87
C: Filler content (%)	1	2	3	4
D:Time (min)	5	10	15	20

**Table 4: Experimental Results with Specific Wear rate and S/N ratios**

Expt. No	Sliding velocity m/sec	Normal Load N	Filler content Wt. %	Time min	Specific wear rate mm <sup>3</sup> /Nm	S/N ratio
1	2.512	39.24	1	5	0.000853	61.38
2	5.024	39.24	2	10	0.000196	74.15
3	7.536	39.24	3	15	0.0000469	86.57
4	10.048	39.24	4	20	0.0000857	81.34
5	7.536	49.05	2	5	0.000418	67.57
6	10.048	49.05	1	10	0.000142	76.95
7	2.512	49.05	4	15	0.0000731	82.72
8	5.024	49.05	3	20	0.0000422	87.49
9	10.048	58.86	3	5	0.000140	77.07
10	7.536	58.86	4	10	0.0000609	84.30
11	5.024	58.86	1	15	0.0000947	80.47
12	2.512	58.86	2	20	0.000130	77.72
13	5.024	68.87	4	5	0.000156	76.13
14	2.512	68.87	3	10	0.000240	72.39
15	10.048	68.87	2	15	0.0000372	88.58
16	7.536	68.87	1	20	0.0000675	83.41

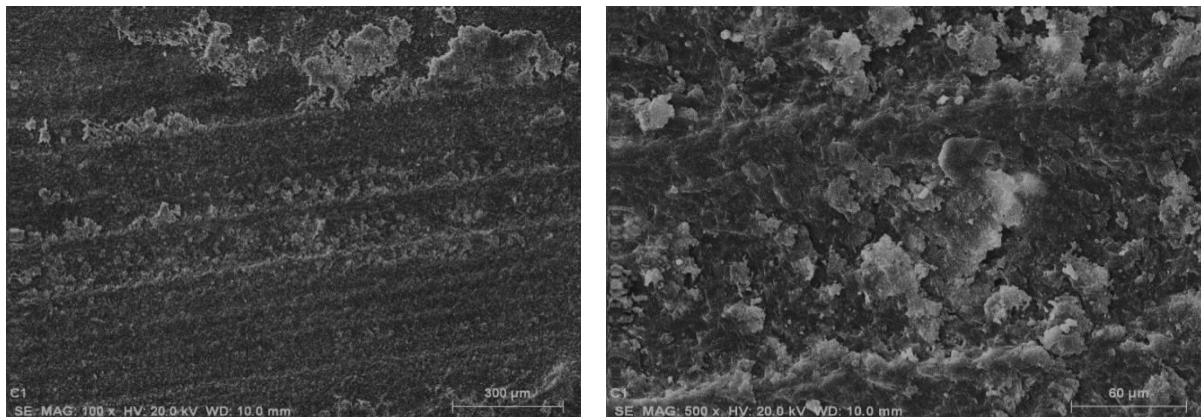
**Table 5: S/N ratios for wear rate**

Level	Sliding Velocity A	Normal Load B	% Filler Content C	Time D
1	73.55	75.86	75.55	70.53
2	79.56	78.68	77.00	76.94
3	80.46	79.89	80.88	<b>84.58</b>
4	<b>80.98</b>	<b>80.12</b>	<b>81.12</b>	82.49
Delta	7.43	4.26	5.57	14.05
Rank	2	4	3	1

The delta is the difference between maximum and minimum values of S/N ratio of particular parameter. Highest value is ranked 1 and has the maximum influence on the process. The result shows that factor combination A4 B4 C4 D3 gives minimum wear rate. Increasing time of contact between pin and disc, the wear rate increases. The minimum time of contact also reported maximum wear with minimum filler content. At a given time of contact the wear rate is sensitive to velocity and filler content. Load bearing ability of the composite is indicated by the decrease in wear rate. These fillers were able to share the portion of normal load applied and hence reduce wear for given time. At sliding interface, frictional heat increases due to increase in sliding velocity for given load and time and this contributes to increase in wear rate. Depending on filler percentage, test duration, applied load and sliding velocity the wear rates of composites are changing.

### 3.3 Morphological Analysis

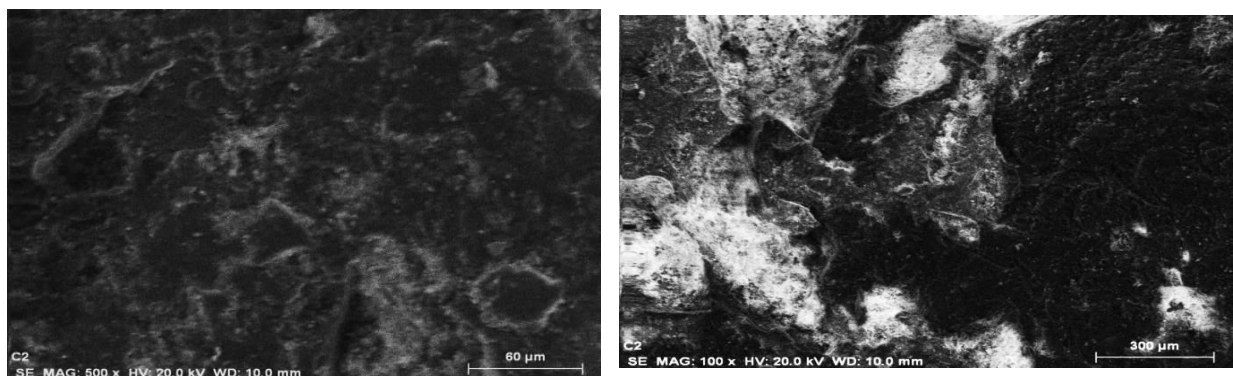
To determine the wear mechanism of the composite the material microstructure plays a very important role. The surfaces of specimens are examined by Scanning Electron Microscopy at National Chemical Laboratories Ltd., Pashan, Pune (Maharashtra).



**Figure 12: SEM micrographs of worn surface of specimen c1 with 100× & 500× magnification**

The SEM morphology of worn surface, with 5 wt. %  $\text{ZrO}_2$  and 2.5 wt. %  $\text{WS}_2$  as fillers and 39.24N load with time of 5 min. shows (figure 12) that scratches produced on the surface parallel to the sliding direction. Due to destruction and transfer of the material from the surface, ploughed marks are seen at higher magnification which indicates that adhesive wear is the dominant wear mechanism. As the filler content in the composite was less, the dispersion of filler particles in the epoxy was insufficient. The wear rate is more because more epoxy matrix was exposed to the rotating steel disc.

Figure 13 shows worn out surface of specimen with 7.5 wt. %  $\text{ZrO}_2$  and 3 wt. %  $\text{WS}_2$  at 49.05N load, time 5 min and speed of 1200 rpm. Here, the wt. % of filler content was increased hence, low wear rate detected compared to composition C1. Increasing load and speed, the temperature at the interface between pin and disc gets increased. This increased temperature softens the epoxy matrix and gets adhered on to the counter surface of disc. The image shows the ploughed marks due to adhesion of the material on disc and hence adhesion wear is dominant.

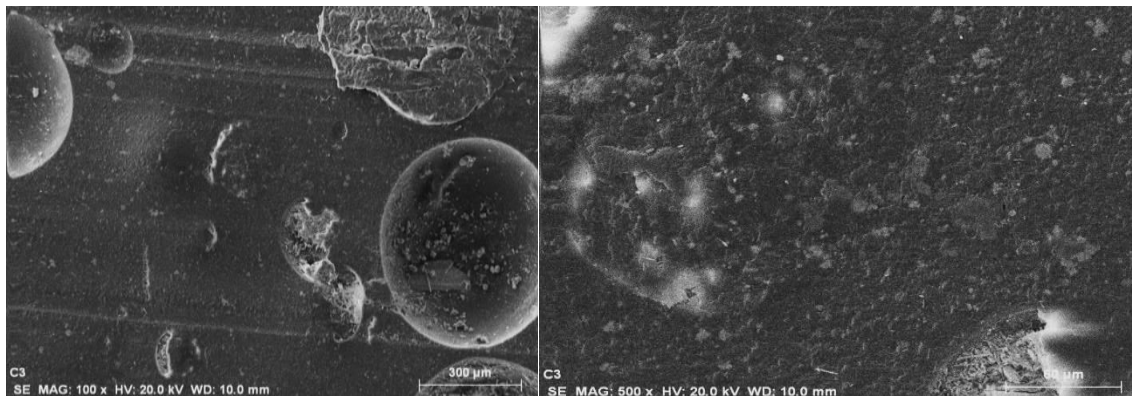


**Figure 13: SEM micrographs of worn surface of specimen C2 with 100× & 500× magnification**

The worn surface feature (figure 14) of composite with 10 wt. %  $\text{ZrO}_2$  and 3.5 wt. %  $\text{WS}_2$  at

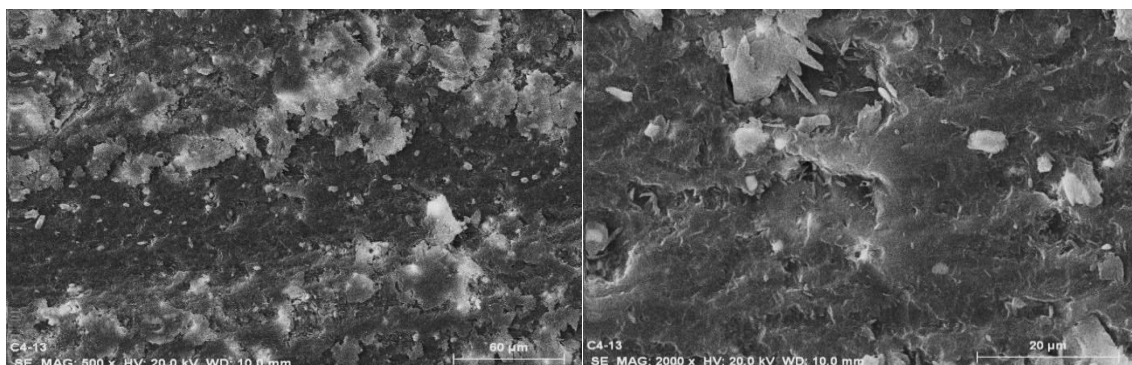


49.05 N loads, speed 800 rpm and time 20 minute reveals that there are voids formed during fabrication of composite. At higher magnification image shows that there is aggregation of filler particles at particular points only due to their improper distribution. At aggregated points the stresses were induced because fillers and resin was not strongly bonded. As a result micro cracks are formed and small debris particles are chipped away from the surface. As less number of abrasive particles is in action with the rubbing surfaces, the wear rate was relatively low at increased percentages of filler content, less normal load and sliding velocity because of low penetration.



**Figure 14: SEM micrographs of worn surface of specimen C3 with 100× & 500× magnification**

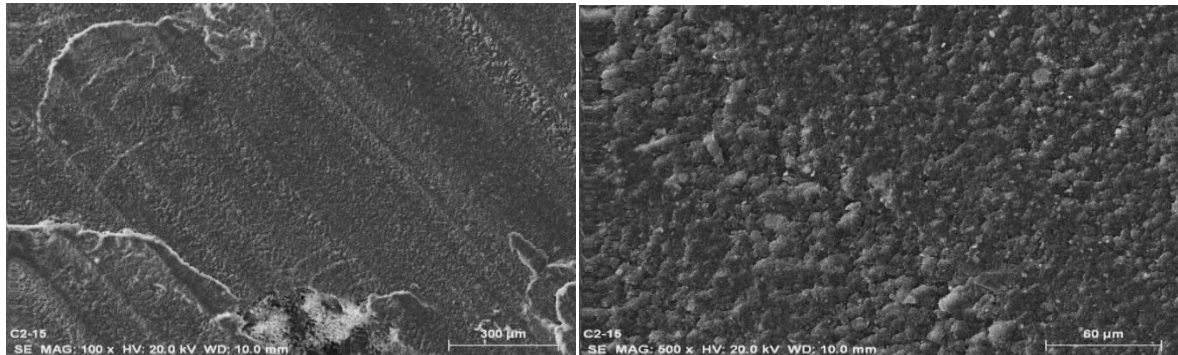
The SEM observation from figure 15 shows debris formation with 12.5% wt.  $ZrO_2$  and 4% wt.  $WS_2$  at 68.87 N loads and at speed 800 rpm. The image shows that grooves are formed on the surface due to asperities going deeper into the surface. There is severe deterioration of surface as applied load is higher. It can be seen from the image that due to increase in normal load the material was removed in the form of large blocks which might be captured in between rotating disc and pin and abrade the surface of pin. These crater formation indicates that fatigue wear took place that corresponds to poor wear resistance of composite.



**Figure 15: SEM micrographs of worn surface of specimen C4 with 500× & 2000× magnification**

Figure 16 shows worn out surface of specimens with 7.5 wt. %  $ZrO_2$  and 3 wt. %  $WS_2$  at 68.87 N loads, speed of 1600 rpm and time as 15 min. Load and sliding speed influence strongly on wear rate. The wear rate is high at high pressure –velocity parameter. But, in this case as the load and velocity is high, the temperature at interface between pin and disc

has been increased which results in plastic deformation of the composite material on counter face of disc, due to this transfer film has been formed. The wear resistance of of polymer could be effectively improved by the transfer film formed



**Figure 16: SEM micrographs of worn surface of specimen C15 with 100× & 500× magnification**

#### 4 CONCLUSION

The following conclusions can be drawn from the experimental studies of ZrO<sub>2</sub> and WS<sub>2</sub> filled epoxy composite:-

##### I. Mechanical properties

- i. This work shows the successful incorporation of ZrO<sub>2</sub> and WS<sub>2</sub> fillers into epoxy matrix.
- ii. Incorporation of fillers into the polymer shows improvement in density, hardness, tensile strength and flexural strength as compared to pure epoxy. The tensile strength is best having strength 36.82 MPa with density 1.233 g/cm<sup>3</sup> which is a good strength-to-weight combination to be used in industrial applications.
- iii. Impact strength is highest 41 J/m in a composite with no filler content.
- iv. The optimum mechanical properties are observed at C5.

##### II. Tribological properties

- i. Dry sliding wear response of these composites is successfully analyzed by Taguchi's design of experiment. It is concluded that influencing parameters affecting specific wear rate are as 1) Time 2) Sliding Velocity 3) Filler content 4) Normal Load.
- ii. Composites with the reinforcement of fillers exhibit significantly improved sliding wear resistance.
- iii. SEM micrograph suggests that the microstructure of the epoxy is changed by reinforcement of the WS<sub>2</sub> and ZrO<sub>2</sub> particles in the epoxy.
- iv. Change in wear mechanism is revealed by worn surface features.

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# Green Practices: A Study Of Consumer Perception And Preferences In 5 Star Hotels In Pune And Mumbai

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Keywords	Green Practices In Hotels, Willingness Of Guest To Pay, Guest Preferences				

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## Abstract

*This research study provides a brief review of environmental issues in hotels and identifies the green values of the consumers, their level of awareness about environmental issues, green products and practices. Though there are talks in circles about think luxury, think responsibly, being responsible without compromising on guest experience is rather a challenge. Non-Green hotels are not only practicing green initiatives but also encouraging guest's participation. This paper highlights the consumers' perception and preferences towards green practices and products that are currently adopted by 5 star hotels in Pune and Mumbai, with the help of a structured questionnaire.*



## 1. INTRODUCTION

Tourism, which invariably is a major source of income and employment for many countries, depends heavily on environmental resources that include immaculate beaches, warm climate, clean air, landscape formation among others (Kasimu, Zaitun & Hassan, 2012). Among the various components of tourism, the hotel industry by its virtue of activities constitute a threat to the ecosystem due to its high consumption in energy, water and non-durable goods (Kasimu, Zaleha, & Hassan, 2012; Kasim, 2009). The hotel industry which plays a vital role in the expansion of tourism, is not considered to be the sole polluter of the environment, but does consume a sizable amount of the global resources.

The primary objective of the hotel industry is to provide its guest with a comfortable luxurious stay with ample amount of services and supplies. These services and supplies most importantly include provision of ample amount of water, optimum quality of linen and towels, exotic and good quality food, lighting, air conditioning and transport services. Organizations across the globe, in all sectors, try and develop products and services with reduced environmental impact as a part of socially accountable practices, however organizations additionally also follow safe environment practices so as to ascertain themselves in a very new niche for customers with environmental concerns. Similarly, hotel operators are also well aware of the benefits of Green Practices and the positive impacts of sustainability.

Of late as more environmental awareness in on the rise and newer rules and regulations have been established to protect the environment, hotel guests tend to prefer eco- sensitive hotels or “green hotels” as compared to conventional hotels. A “Green hotel” is defined as an eco-friendly hotel operation that performs various environmentally friendly practices/programs such as saving water/energy, using eco-friendly purchasing policies and reducing emission/waste disposals to protect the natural environment and reduce operational costs (Green Hotel Association, 2008).

Nonetheless conventional or non- green hotels are getting increasingly competitive by blending in with the positive attitude of hotel guests towards accepting green practices.

Unlike conventional hotels, green hotels follow a strict guideline when it concerns the operations of the property. Some of the basic operations adopted by conventional or green hotels with regards to conserving the environment as well are as follows:

- i. Linen reuse programs
- ii. Biodegradable and renewable products
- iii. Water and energy efficiency
- iv. Low emitting
- v. Serving of organic grown food
- vi. Use of renewable energy resources like solar or wind energy.
- vii. Use of non- toxic cleaning and laundry agents.

Since guest pay for high quality of hotel services, which include luxury and pampering, hotels satisfy their guests with a high amount of natural resource consumption in an effort to co relate with quality service. But with the changing trend, environmentally sensitive

customers value the utility of these natural resources and tend to support and preserve them, even if needed at an extra cost.

## 2. LITERATURE REVIEW

- I. The environmental concerns in India are increasingly alarming especially in the tourism industry. Guests who visit hotels in India are aware of the environment friendly practices that are adopted (Kamal Manaktola and Vinnie Jauhari, 2007). They visit hotels that have adapted green practices without compromising on the quality of service. In their study they also mention that though they would like to use the services of green hotels, they are unwilling to pay an extra amount for the same. The research paper attempts to bring out facts regarding customer purchasing behavior towards green practices in the Indian hotel industry.
- II. Heesup Han et al (2011) in their study endeavored to answer the accompanying examination questions: Do eco-friendly customers who stay at hotels have expectations from green lodging are willing to spend more for the services as well as spread awareness through word of mouth? If things being what they are, which feature of guests attitudes has the best effect? How do their communicated aims contrast crosswise over sexual orientation, age, education, and family wage?; How do such communicated aims contrast with past experience staying at a green hotel? Their study showed that eco-friendly intentions of guests did not considerably change across sexual orientation, age, education, and family wage.
- III. Naresh Naik and Abhishek Rao (2014) state that India is a nation with long history and rich social legacies. It has bottomless tourism assets and an extensive variety of tourism offices, making it a standout amongst the most celebrated traveller destinations on the planet. Be that as it may, the proceeding with improvement of the tourism business and its contention with ecological assurance has turned into an issue for some nations. Creating green hotels could be one answer for the issue. Be that as it may, buyers' comprehension of green hotels is very constrained. It was found that customers were not clear about the attributes of a green hotel. Distinctive classifications of customers have diverse observations around a green lodging. Shoppers would like to help and enhance green utilization while lodgings want to fortify administration and offers of green hotels. This Study broke down the familiarity with the general population about Environment-accommodating projects in hotels and degree to which such projects impacted client's lodging choice.
- IV. Nor Azila Mohd Noor, Hasnizam Shaari and Dileep Kumar (2014): The accommodation business overall is being pressurized by numerous strengths to be more ecologically inviting. Lodgings are turning out to be more mindful of their effect and are taking an interest in green activities. As more travellers are turning out to be progressively concerned with regards to nature, it is essential for the lodging business to investigate this idea of green hotels in more detail. In the hotel business, green hotels are characterized as hotel foundations that have made a guarantee to assist in naturally stable practices, for

example, sparing water, vitality, and lessening strong waste. This study analyzes the impact of natural mentalities and inn credits on voyagers' aim to pick green inns as their favoured settlement. The study affirms past discoveries on the relationship between attitudes of guests and eco- friendly measures. The study found a positive and huge relationship of green hotel credits and stay at green lodging among vacationers.

- V. Yong Han Ahn and Annie R. Pearce (2007) in their study state that the hotel business is starting to actualize green configuration and development works which include sparing vitality, water, and assets and along these lines protecting the earth. Moreover, green building also can give strong and pleasant indoor circumstances to hotel tenants including guests and delegates. In any case, there is the potential for strife between green building practices and hotel guests' satisfaction and comfort, as the protection of benefits could detract from the way of a hotel guest's experience. This study speaks of a contextual analysis way to deal with aspects that make a green and rich environment without harming the hotel's money related position. From the point of view of the whole lifecycle of the building, this information was broke down to distinguish green configuration and development that give a green, extravagant environment as well as improve the lodgings' budgetary quality.
- VI. Kasim (2004) studied tourists to Penang Island, Malaysia and found that tourists were sensitive and cared about nature but they did not consider a hotel's environmental technique as a foundation for their hotel choice. This shouldn't imply that that they would not favor of room properties that were ecologically well disposed. Visitors were willing to acknowledge rooms with water sparing elements, reusing receptacles, fire-security features, energy sparing components, and data on nearby ecotourism attractions

### **3. RESEARCH OBJECTIVES**

- i. To investigate the level of awareness of an Indian hotel consumers about green practices carried out in a hotel
- ii. The willingness of guests to pay for green practices and services.
- iii. To identify a list of green practices that hotel guests would prefer to have in their hotel.
- iv. To study how guests evaluate the performance of green practices implemented by the hotels.
- v. To study whether the green perceptions in the hotel are different based on the guest's demographic characteristics.

### **4. METHODOLOGY**

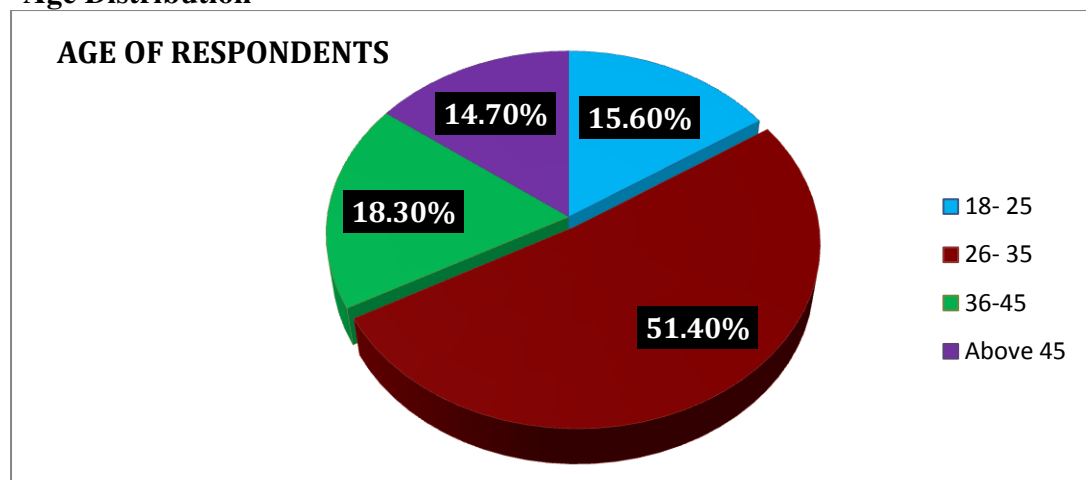
This research was carried out using the survey strategy, where data was collected from guests who have stayed in 5 star hotels in the cities of Pune and Mumbai. The prime purpose of the study was to ascertain the guests 'awareness of green practices carried out in hotels and their willingness to pay for it. Awareness of customers about the various practices followed in the hotels were analyzed with the help of a closed ended questionnaire. This study selected environmental attributes based action programs. The sampling

population consisted of hotel guests, the questionnaire was also circulated online amongst travellers. The questionnaires were emailed as well to a set of contacts at random. Out of 197 distributed questionnaires, 110 complete questionnaires were analyzed. The respondents were asked to rate the statement on 'hotel green practices as per your preference' on a 5 point scale ranging from most preferred to least preferred. Since the neutral point on the scale was 3, those means above 3 suggests overall positive inclination with the statement.

## 5. DATA ANALYSIS

The questionnaire involved queries regarding the respondent's age, marital status, city in which they have stayed as guests in 5 star hotels (Pune and /or Mumbai), green practices observed, preferences for the green practices, and willingness to pay an extra amount for these eco-friendly measures.

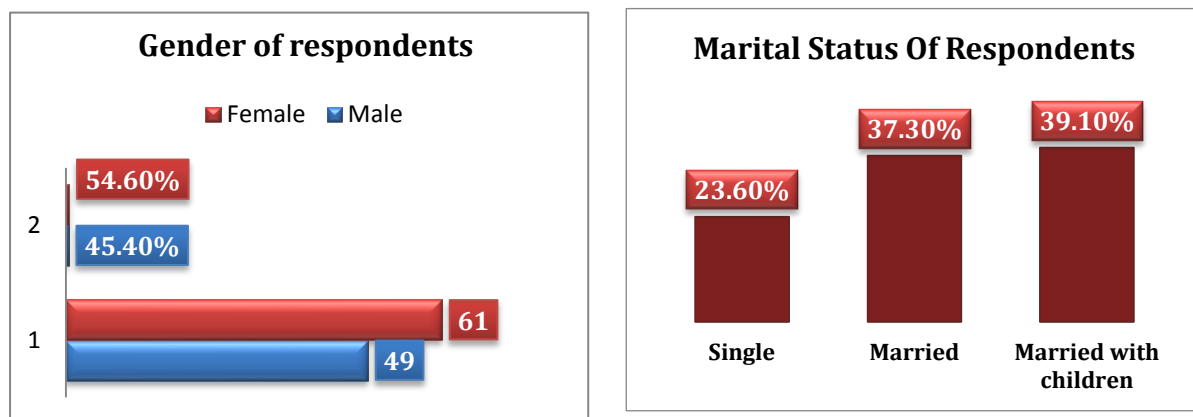
### I. Age Distribution



**Figure 1: Distribution of sample according to age**

According to the results, maximum numbers of respondents were from the age group of 26- 35 years. This shows that the said age group travels and stays most with 5 star hotels in Pune and Mumbai.

### II. Gender and Marital Status

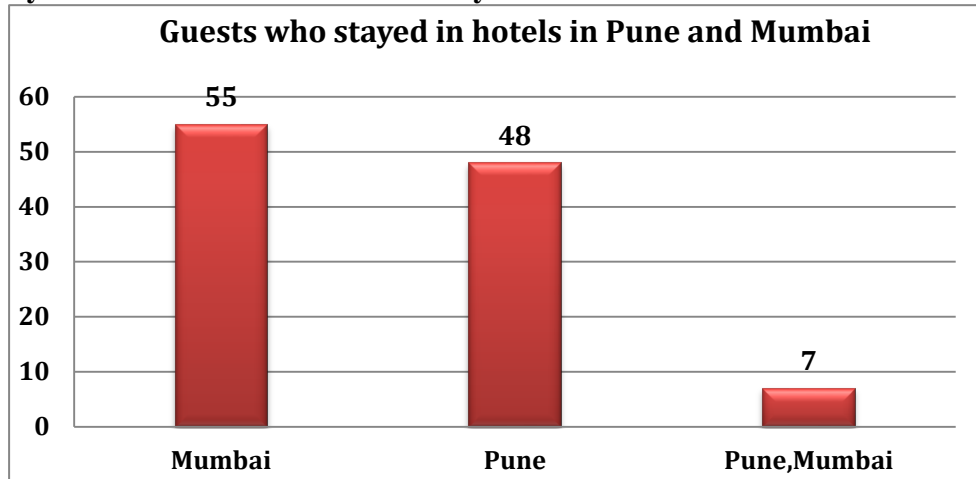


**Figure 2: Distribution of sample according to Gender and Marital Status**



The majority of the respondents were female (54.60%), as compared to male visitors (45.40%), while most of the respondents were married with children (39.10%). The single respondents were lesser in number (23.60%).

### III. City In Which The Guests Have Stayed



**Figure 3: Distribution of sample according to City (Mumbai, Pune, both)**

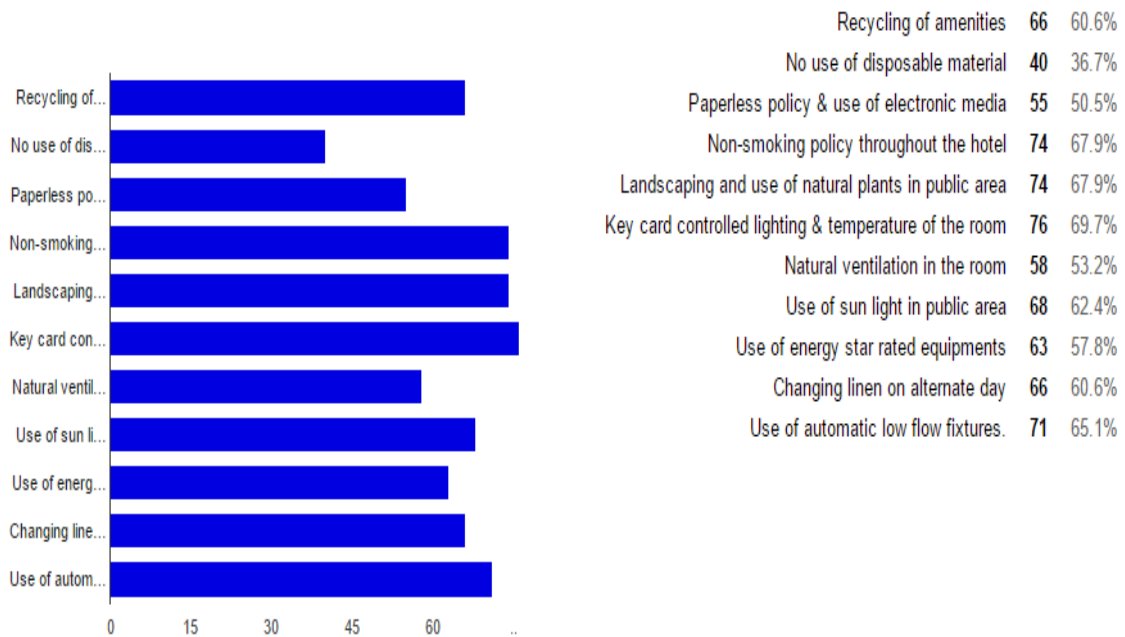
Majority of guests have resided in the city of Mumbai as compared to Pune, wherein 7 guests have resided in hotels in both the cities.



**Figure 4: Do you feel that implementing green practices is need of an hour?**



**Figure 4: Hotels Implemented Green Practices in their day routine**



**Figure 6: Green Practices preferred by guests**

The above data shows that 99.1% respondents have mentioned that implementing green practices is the need of the hour for hotels in Pune and Mumbai and a considerable amount of 89.1% of hotels have implemented green practices in their daily operations.(Figure 4 and 5).

**Table 1: Green Practices preferred by hotel guests rating based on Percentage**

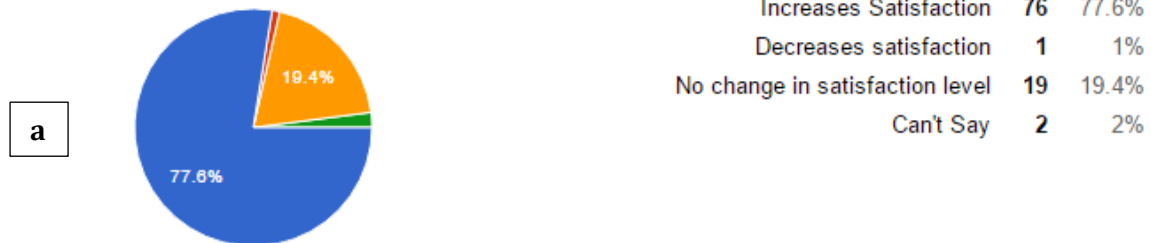
Sr. No	Green Practices preferred by hotel guests	Rating based on Percentage
1	Recycling of amenities	60.60%
2	No use of disposable material	36.70%
3	Paperless policy & use of electronic media	50.50%
4	Non-smoking policy throughout the hotel	67.90%
5	Landscaping and use of natural plants in public area	67.90%
6	Key card controlled lighting & temperature of the room (ECO)	69.70%
7	Natural ventilation in the room	53.20%
8	Use of sun light in public area (Skylight)	62.40%
9	Use of energy star rated equipment	57.80%
10	Changing linen on alternate day	60.60%
11	Use of automatic low flow fixtures.	65.10%

Of the 11 environmental friendly attributes, Key card controlled lighting & temperature of the room, commonly known as ECO, is most preferred by guests. This attribute has the highest rating of 69.70%, followed by non- smoking policy as well as Landscaping and use of natural plants in public area.

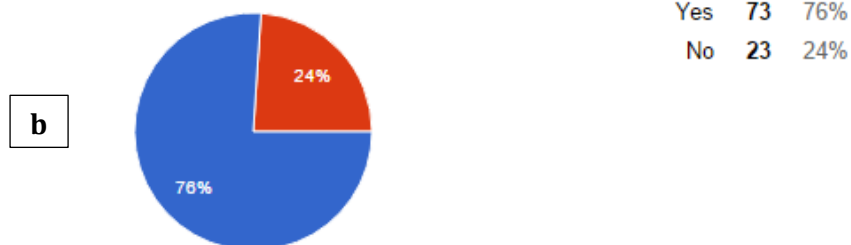
The concept of ECO helps in saving electricity. The ECO button is located at the bedside and when pressed by the guest, the air conditioner temperature in the room increases by 2 degrees for a period of about 2 hours. The amount of money saved by a guest is reflected on

the guest folio, and a certificate is issued to a guest for participating in this energy conservation activity voluntarily.

#### Does being a consumer of green practices hamper your satisfaction level?



#### Would you be paying an extra amount (if required) to the hotels in order to avail the green services?



**Figure 7(a, b): Green Practices Satisfaction level & opinion to avail green practices**

The data suggests that hotel guests today have an extremely positive affiliation towards Green Practices carried out in hotels, majority of guests have stated that being a consumer of Green practices has increased their satisfaction level. Data also implies that hotel guests have a strong willingness to pay an extra amount with regards to hotels environmental initiatives.

## 6. FINDINGS AND CONCLUSIONS

The primary purpose of this study was to investigate the level of awareness of green practices carried out in hotels, by guests. For most part of the study, the responses of guests who have stayed in 5 star hotels in Pune and Mumbai were favorable towards green attributes adopted by hotels. Generally, the younger respondents (26 to 35 years) of the study appeared to be more in support some of the green attributes, one of the reasons could be that youngsters today are more well-travelled and aware of the threats that pose the environment. The study shows that majority of respondents were Female (54.60%), and respondents Married with children (39.10%), demonstrates that the quantity of visitors going to hotels with kids is additionally on the ascent. Most part of the study with respect to green attributes such as Use of skylights, changing linen on alternate days, paperless policy to name a few, were well received by the respondents. The study also states that hotel guests are willing to pay an extra amount for these environmental attributes adopted by the hotels and by no means does it decrease their satisfaction levels.

The consequences of this study will help 5 star hoteliers in the city of Pune and Mumbai to start to comprehend that such green attributes are critical to their customers and that they can be consolidated into the visitor room. It additionally gives potential hotel guests an unmistakable picture of what a 'Green Hotel' would be like. Hoteliers again can utilize this study by taking advantage of the business sector, i.e. the younger traveller's, female guests and those married with children.

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# A Scientometric Study On High Blood Pressure Research During The Year 2011-2015

<b>Paper ID</b>	<b>IJIFR/V3/ E12/ 041</b>	<b>Page No.</b>	<b>4560-4569</b>	<b>Subject Area</b>	<b>Library and Information Science</b>
<b>Keywords</b>	Scientometrics, Bib excel, High Blood Pressure, Authors Productivity, Authorship Pattern, Relative Growth Rate, Country Wise Authors, Web Of Science				

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## Abstract

*This study evaluates the Scientometrics study on high blood pressure research during the year 2011-2015. The data were downloaded from Web of Science database which was maintained by Thomson Reuters. Total numbers of records were 1152. The result of such studies may be very useful for the research administrators, policy makers and funding agencies. High blood pressure is a progressive disease, signs and symptoms slowly worsen over time. There is no change to do well. The collected data were analyzed with the help of 'Bibexcel tool'. The study also applied statistical tools such as year wise, Authorship pattern, Relative Growth Rate, Country wise authors etc.*

## 1. INTRODUCTION

Bibliometric is the type of research method; it is an emerging area of research in the Library and Information Science field. The term "bibliometrics" is coined from two words "biblio"

and “metrics”. The word biblio is derived from the combination of a Latin and Greek word biblion-means a book or paper, metrics indicates the science of metric i.e. measurement. Blood is pumped by the heart through vessels to bring oxygen and nutrients to the body. Blood pressure is the force of the blood against the vessel walls. The higher the pressure, the harder the heart is working. Blood pressure often goes up and down during the day. When it goes up and stays high, then it is high blood pressure. The medical term is hypertension. The test gives two numbers: The systolic pressure is the pressure of blood in the vessels as the heart beats. The diastolic pressure is the pressure of the blood between heartbeats. The numbers are usually written like a fraction with the systolic above or to the left. An example is 120/80 mm Hg (millimeters of mercury), a normal adult blood pressure.

## 2. REVIEW OF LITERATURE

- **Thirumagal A (2013)<sup>1</sup>** this study deal with the bibliometrics study on the publication of “Osteoarthritis” research. The records are collected from Pub MED resource MEDLINE for the period of 2001 to Osteoarthritis 2012. Total number of records for this study was 31,465. Osteoarthritis is a progressive disease, signs and symptoms slowly worsen over time. However, available treatment may help with pain and swelling (inflammation), as well as keeping the patient mobile and active. The collected data were analyzed with the help of ‘Bibexcel tool’.
- **Surulinathi, M et al. (2013)<sup>2</sup>** has analyzed the growth and development of green computing, as reflected in publication output covered by the Web of Science (WoS) online database [1956-11]. Among the 42 countries of her analysis, Germany has produced 270 (16.24 percent) articles and occupied the first place of the European continent. France and Italy have more than 200 articles produced in this field, while the UK and Spain have contributed more than 100 articles.
- **Rubinandhini A and Gomathi P (2015)<sup>3</sup>** this study focuses on the journal from the Annals of Library and Information Studies. This study covers the total number of 324 articles studied only the one journal with five years (2005 to 2014). This paper discusses on authorship pattern, citation analysis, Publication Efficiency Index, length of articles, relative growth rate, Distribution of year wise citation analysis, degree of collaboration, country wise distribution of publications, and time series analysis of total authored papers also.

## 3. RESEARCH METHODOLOGY AND LIMITATION OF THE STUDY

The data for the study were retrieved from Web of Science database, which is a scientific and indexing service maintained by Thomson Reuters. The high blood pressure research output was analyzed. For this study bibliographic details such as author wise, document type, collaboration, etc. was analyzed using bibexcel. Bibexcel is a software package used for bibliometric analysis and information visualization. The collected data were analyzed with the bib excel software, Manual, Microsoft Excel Sheet and presented in the form of tables.

#### 4. OBJECTIVES OF THE STUDY

- To find out the year wise distribution of the article, and Authorship pattern of publication.
- To examine the Single author Vs Multi authors, prolific authors.
- To identify the Relative Growth Rate and Doubling Time for research output.
- To calculate the Exponential Growth Rate, Language wise distribution.
- To determine the document type distribution of tuberculosis research.
- To identify the country wise distribution of the publication.

#### 5. DATA ANALYSIS AND INTERPRETATION

Table-1 Year wise distribution of articles

S. No	Year	Records	%
1	2011	232	20.14
2	2012	219	19.01
3	2013	247	21.44
4	2014	236	20.49
5	2015	218	18.92
Total		1152	100

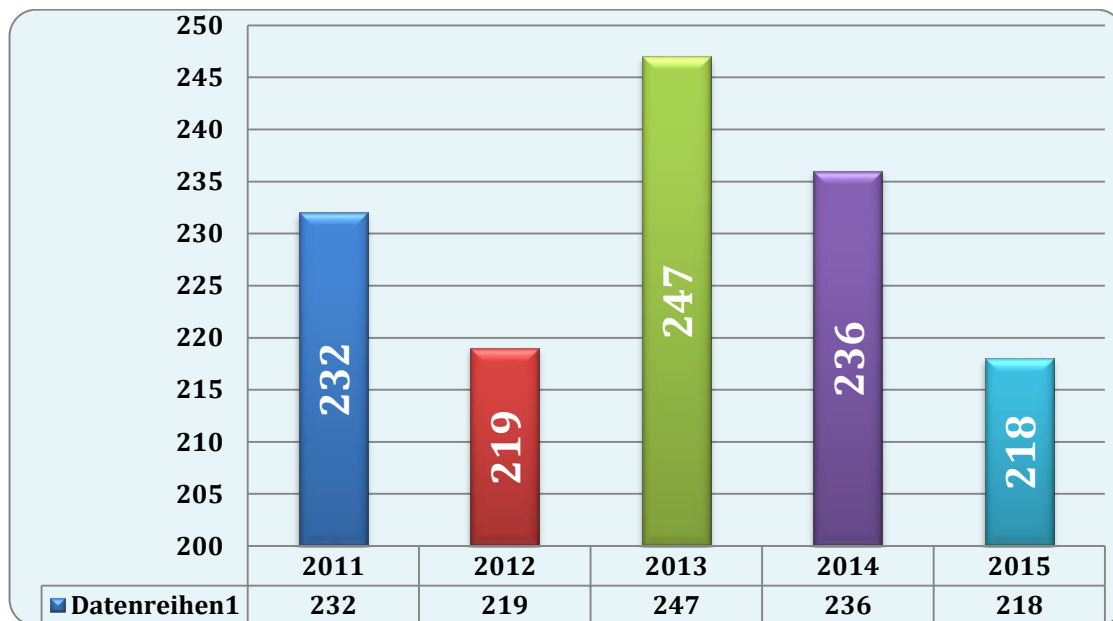


Figure -1: Year wise Distribution of Articles

Table 1 and figure 1 shows that year wise distribution of publications of high blood pressure research output in the year of 2011 to 2015 (5 years) a total of publications 1152 were published. The highest number of publications 247 (21.44%) in the year 2013 followed by 2014 ie 236 (20.49%). The lowest number of publications 218 (18.92%) in the year 2015. The study reveals that the majority of the articles published in the year of 247 (21.44%)

Table – 2 Authorship pattern of Publication

S. No	Authors	No. of. Publications	%
1	Single author	111	9.64
2	Two authors	159	13.80
3	Three authors	131	11.37
4	Four authors	154	13.37
5	Five authors	125	10.85
d6	Six authors	101	8.77
7	Seven authors	89	7.73
8	Eight authors	77	6.68
9	Nine authors	47	4.08
10	Ten authors	38	3.30
11	Above ten authors	120	10.42
Total		1152	100

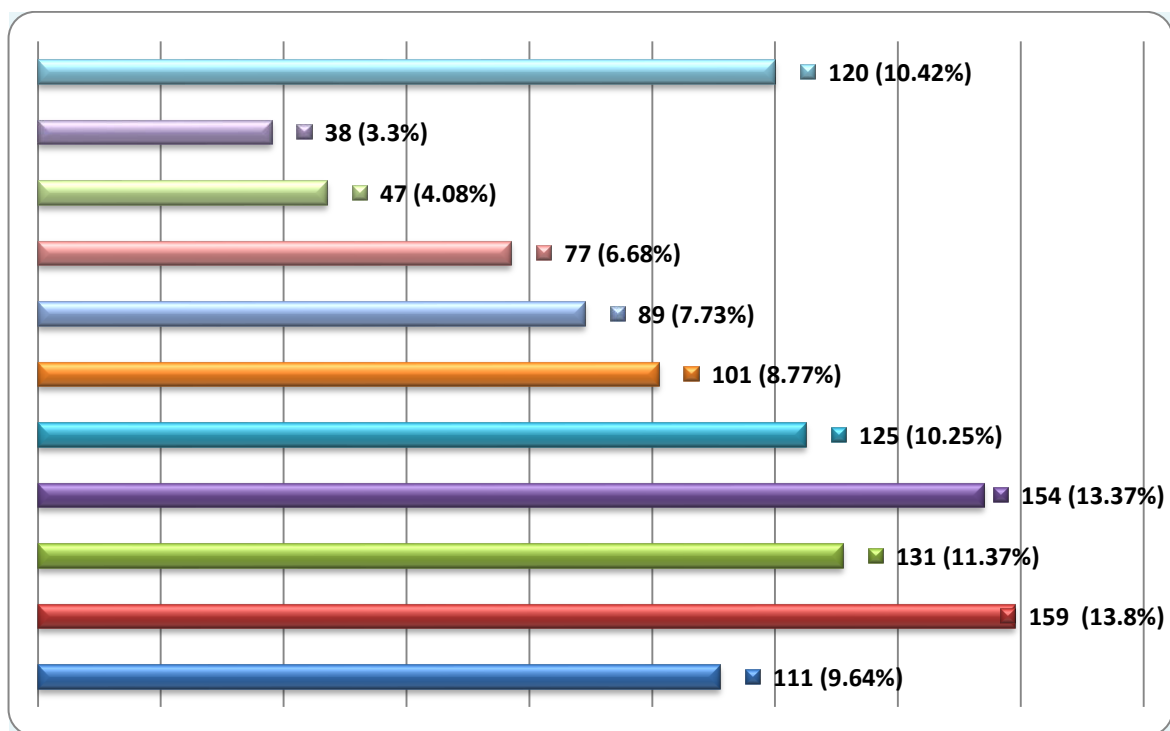


Figure – 2: Authorship pattern of Publications

Table 2 and Figure 2 examine that the year wise authorship pattern. Among this authorship pattern, highest number of papers published by two authors 159 (13.80%), followed by four authors 154 (13.37%). Three authors were 131 (11.37%), Five authors were 125 (10.87%), more than ten authors were 120 (10.42%), Single authors were 111 (9.64%), Six authors were 101 (8.77%), Seven authors were 89 (7.73%), Eight authors were 77 (6.68%), Nine authors were 47 (4.08%), Ten authors 38 (3.30%). This study reveals that the majority of the articles published by two authors 159 (13.80%).



Table – 3 Single vs. Multi Authors

S. No	Authorship Pattern	Publications	%
1	Single Author	111	9.64
2	Multiple Authors	1041	90.36
Total		1152	100

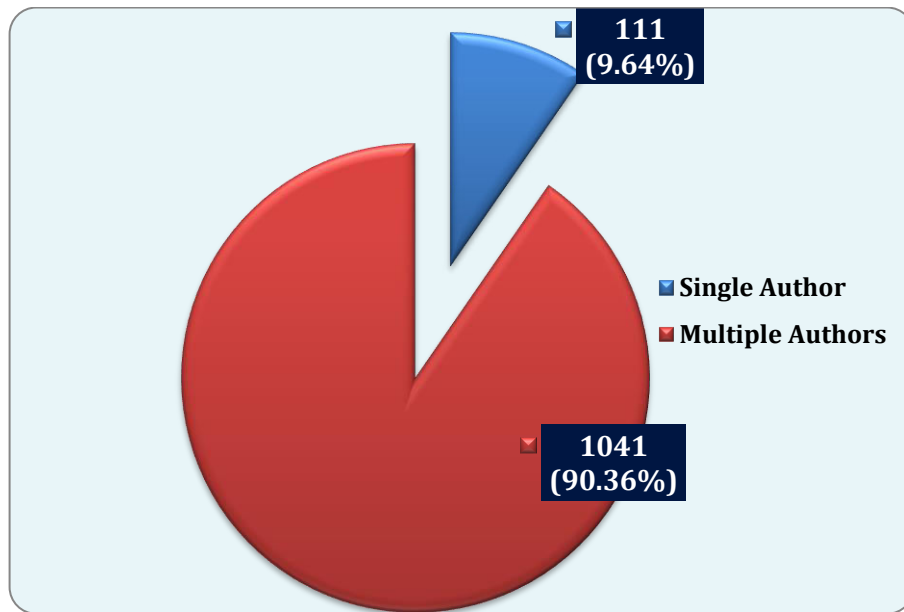


Figure – 3.1: Single vs. Multi Authors

Table 3 and figure 3.1 shows that the single author Vs multiple authors of high blood pressure research output during the year 2011-2015. For the purpose of analysis, the researchers have classified the study into two phases viz., first phase Single author and next phase Multi-authors. It is clear from the following that the Single author records are 111 (9.64%) and multiple authors were 1041 (90.36%). Finally the majority of the articles published in multiple authors in this period from 2011 to 2015.

Table – 4: Prolific author's wise distribution of articles (Top Ten)

S. No	Prolific Authors	Records	%
1	Oparil S	19	1.22
2	Lackland DT	13	0.83
3	Han HR	10	0.64
4	Levy D	9	0.58
5	Bakris GL	9	0.58
6	Muntner P	9	0.58
7	Kim MT	9	0.58
8	Bangalore S	9	0.58
9	Sherwood A	8	0.51
10	Calhoun DA	8	0.51

Table 4 shows in these analysis 501 prolific authors and 1152 records. It reveals that Operil S is the most productive author contributing 19 (1.22%) articles followed by Lackland DT with 13 (0.83%) articles and Han HR with 10 (0.64%) articles respectively. And a total of 501 prolific authors is contributed entire research output of the period under study. This study reveals that Operil S is the most productive author contributing 19 (1.22%) articles.

**Table – 5: Relative Growth Rate and Doubling Time of Tuberculosis Publications**

Year	No. of Publications	Cumulative No. of Publications	W1	W2	R (a) (W1-W2)	Mean R (a) 1-2	Doubling Time	M Dt(a)1-2
2011	232	232	-	5.45	-	0.59	-	0.54
2012	219	451	5.39	6.11	0.72		0.96	
2013	247	698	5.51	6.55	1.04		0.67	
2014	236	934	5.46	6.84	1.38	1.53	0.50	0.46
2015	218	1152	5.38	7.05	1.67		0.41	
<b>Total</b>	<b>1152</b>					<b>1.06</b>		<b>0.5</b>

Table 5 shows that the relative growth rate of total contribution published had gradually increased. The growth rate in 0.72 in 2012, which is increased up to 1.67 in 2015. The mean relative growth rate during the period 2011-2013 was 0.59 and it was increased during the year 2014-2015 was 1.53. The overall study period has witnessed a mean Relative Growth Rate in 1.06. In general the relative growth rate of publications of all sources in high blood pressure output has shown an increasing trend. The mean doubling time during the period 2011-2013 is 0.54 and for 2014 to 2015 is 0.46. The overall study period has witnessed a mean doubling time as 0.5.

**Table – 6: Exponential Growth rate**

S. No	Year	No. of Publication	Exponential Growth rate
1	2011	232	-
2	2012	219	0.94
3	2013	247	1.13
4	2014	236	0.96
5	2015	218	0.92
<b>Total</b>		<b>1152</b>	<b>3.95</b>

Table 6 shows that Exponential Growth Rate of publications in high blood pressure during the period of 2011 to 2015 (5 years). The highest growth rate 1.13 was found during 2013 with 247 publications. Followed by the year 0.96 was found during 2014 with 236 publications. Followed by 0.94 was found during 2012 with 219 publications. The lowest growth rate 0.92 was found during 2015 with 218 publications. It is also found that the

Exponential Growth Rate was found to be 3.95 and average growth rate has positive value showing the increasing trend in the high blood pressure research.

**Table – 7: Language wise distributions**

S. No	Language	No. of. Publication	%
1	English	1150	99.82
2	Spanish	1	0.09
3	Russian	1	0.09
<b>Total</b>		<b>1152</b>	<b>100</b>

The distribution of high blood pressure literature by language wise shown in table 7 the scholarly communication is effected through English language in almost all the countries, irrespective of the native language of the subject of high blood pressure which published about 1150 (99.82%) of the research output in English. Followed by 1 (0.09%) research output in Spanish, followed by Russian language 1 (0.09%) The study concludes that the majority of the articles is published in English Language i.e, 1150 (99.82%).

**Table – 8 : Type of document wise distribution of Publications**

S. No	Document Type	Records	%
1	Article	919	79.77
2	Review	129	11.20
3	Editorial Material	68	5.90
4	Meeting Abstract	29	2.52
5	Review; Book Chapter	4	0.35
6	Article; Book Chapter	1	0.09
7	Letter	1	0.09
8	Article; Proceedings Paper	1	0.09
<b>Total</b>		<b>1152</b>	<b>100</b>

Table 8 reveals that the type of document wise distribution of publications. It is an accepted fact that most of the scholarly communication of scientific research is published in articles 919 (79.77%), followed by Review 129 (11.20%). Editorial Material were 68 (5.90%), Meeting Abstract were 29 (2.52%), Review; Book chapter were 4 (0.35%). The minimum level of 1 (0.09%) has published in the review; book chapter, Letter, Article; Book Chapter. Finally, most of the scholarly communication of scientific research is published in articles 919 (79.77%).

**Table – 9: Country wise distribution of publications (Top Twenty)**

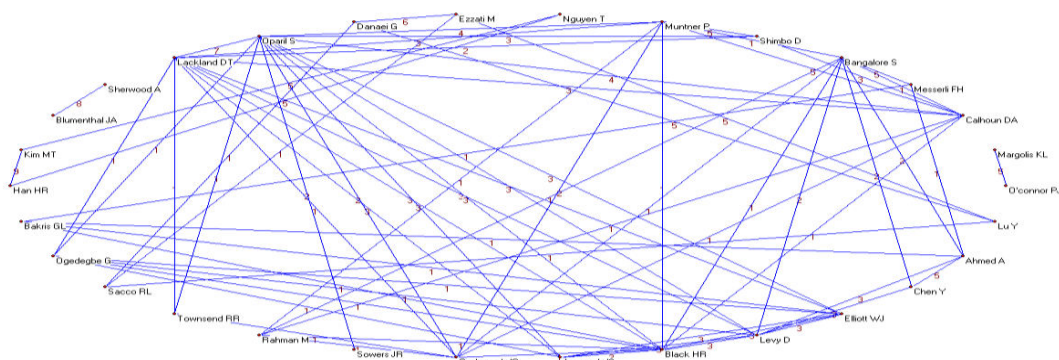
S. No	COUNTRY	Records	%
1	USA	1147	69.31
2	Peoples R China	62	3.75
3	UK	45	2.72
4	Australia	32	1.93
5	Canada	28	1.69
6	South Korea	19	1.15
7	Italy	16	0.97
8	Sweden	15	0.91

9	Japan	14	0.85
10	Germany	14	0.85
11	Spain	14	0.85
12	France	13	0.79
13	Brazil	12	0.73
14	Netherlands	12	0.73
15	India	10	0.60
16	Switzerland	10	0.60
17	Greece	10	0.60
18	South Africa	10	0.60
19	Poland	8	0.48
20	Bangladesh	8	0.48

The total number of publications in high blood pressure were 1655 international collaboration during the period 2011 to 2015, of which contribution of top 20 countries are listed in table 9 the largest contribution to international collaborative papers of India in high blood pressure research comes from 1147 (69.31%) it is dominated first position of the USA. Followed by the country China 62 (3.75%). UK were 45 (2.72%), Australia were 32 (1.93%), Canada were 28 (1.69%). The study reveals that the USA were published the majority of the articles are 1147 (69.31%).

**Table – 10 : Country collaboration on high blood pressure research output. (Top 10)**

S.NO	County Collaboration		Total	%
1	Peoples R China	USA	61	9.55
2	UK	USA	45	7.04
3	Australia	USA	32	5.01
4	Canada	USA	28	4.38
5	South Korea	USA	19	2.97
6	Italy	USA	16	2.50
7	Sweden	USA	15	2.35
8	Germany	USA	14	2.19
9	Japan	USA	14	2.19
10	Spain	USA	14	2.19



**Table 10 and figure 10.1 shows in this analysis 639 country collaborative and 1152 records of high blood pressure research in top 10.**



It reveals that Peoples R China collaborated with USA country in 61 (9.55%) of records, followed by UK collaborated USA country in 45 (7.04%) of records, followed by Australia collaborated with USA country in 32(5.01%) of records, followed by Canada USA country in 28 (4.38%) of records. Finally, this study details about USA country was collaborating with other countries.

## 6. FINDINGS AND CONCLUSION

- i.) This study extent the total number of research literature published in the web of science database regarding on high blood pressure research output in the year of 2011 to 2015 (5 years) a total of publications 1152 were published.
- ii.) The highest number of publications 247 (21.44%) in the year 2013.
- iii.) It is clear from the authorship pattern, highest level of publications are from two authors 159 (13.80%).
- iv.) The majority of the articles were published in multiple authors in this period from 2011 to 2015.
- v.) 501 prolific authors and 1152 records have produced. Mr.Operil S is the most productive author contributing 19 (1.22%) articles.
- vi.) The overall study period has witnessed a mean Relative Growth Rate in 1.06. The Mean doubling time is 0.5.
- vii.) It is also found that the Exponential Growth Rate was 3.95.
- viii.) English language in almost all the countries 1150 (99.82%).
- ix.) Most of the scholarly communication of scientific research is published in articles 919 (79.77%).
- x.) The largest contribution to International collaborative papers of India in tuberculosis research comes from 3514 (69.75%)
- xi.) The total number of publications in high blood pressure was 1655 international collaboration during the period 2011 to 2015, of which contribution of top 20 countries. The study reveals that the USA were published the majority of articles 1147 (69.31%).
- xii.) Finally, this study details about USA country was collaborated to distribute to other countries.

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# Impact Of Life Skills On Self-Regulated Learning Using Concept Mapping

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Life Skills, Self-Regulated Learning, Concept Mapping, Eleventh Standard Students

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## Abstract

*The major goal of self-regulated learning is to create lifelong learners who can create, share and sustain their knowledge at the global village. Sense of self, intellectual ability, behavioural management and skill development are essential requirement for self-regulated learning. The present study highlights how life skills training help the students to become a self-regulated learner. The major objective of the study was to investigate the effectiveness of life skills training on self-regulated learning of eleventh standard students. Modules on Genetics based on Life skills and Motivated Strategies for Learning Questionnaire were adopted for investigation. The sample consisted of 65 biology group eleventh standard students from Government higher secondary schools. Experimental group was taught by Life skills treatment and control group followed normal method. Post – test was applied for both the groups simultaneously. The result showed that the ‘treated group’ have scored higher level of self-regulated learning than the control group.*

## 1. INTRODUCTION

Self-regulated learning is an individual learning process which makes the students as a proficient learner. It is a mental process that insist multiple activities namely, planning, goal setting, innovative thinking, self-monitoring and evaluation in the learning process. Self-regulated learning needs attention and concentration, self-awareness and introspection, honest self-assessment, openness to change, genuine self-discipline, and acceptance of responsibility for one's learning (Pintrich, 2000; Zimmerman & Schunk, 2001). Literatures of self-regulated learning suggest that cognitive, metacognitive and skilful learning make the learners to learn on their own way (Ericsson, 1994; Abar, Carter and Winsler, 2009).

Self-regulated learning is being associated with 21<sup>st</sup> century skills. Communication, decision making, critical, creative thinking and problem solving skills are basic conditions for self-regulated learners to strengthen the cognitive and metacognitive ability. Life skills education enriches the skills and positive attitudes to learn the content in detail. Life skills are the ability for adopting positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life (World Health Organization, 1999). Life skills education is important for adolescence to reduce their complications. It creates curiosity and active learning among the learners. Students can control and make confidence about their learning, collaborate with their peers, share their knowledge and prepare their own strategy. It can lead to high contribution of self-regulation in the learning process.

## 2. PREVIOUS STUDIES

Lazakidou *et al* (2010) suggested that teaching problem - solving skills enhanced decision making, transmission, and self-governance and responsibility in the students. Kuiper and Pesut (2004) found that self-regulated learning strategies increase the development of critical and reflective thinking within the clinical reasoning context. Higgins *et al* (2005) stated that thinking skills programmes have a greater impact on attainment when they include an explicit focus on metacognitive skills which encourages for research into self-regulated learning. Friesenhahn (1999) confirmed that there is significant difference in the self-esteem of adolescents after Life skills treatment. Ahghar, G. (2012) found that the level of self - regulated learning of students who have received problem-solving skills is significantly higher than the self- regulated learning level of students who have not received this training. Stetanou (2001) suggested that the learners could select their learning goals and try to regulate, control and monitor their cognition, motivation and behaviour.

## 3. NEED AND SIGNIFICANCE

Adolescence period is a crucial stage of students due to hormonal changes and they need concrete support from themselves as well as others when they are taking self-regulation in their learning process. Different teaching and learning methodology, peer and family support and activity based learning make them fully engaged with their learning process.



According to *Mangrulkar (2001)* in varied situations, adolescent needs to practice new skills with peers and other individuals outside the family. When teaching with different methodology, they can easily understand the concept, frame the questions and find the answers, monitor their work to avoid mistakes and verify their process if they need any correction or not. All these positive activities make them as a good academic achiever. Hence teaching the content with different methodology using life skills can create motivation, divergent thinking, self-interest, good behaviour and self-discipline among the learners who turned into self-regulated learner.

#### 4. RESEARCH QUESTIONS, OBJECTIVES & HYPOTHESES

The present study attempted to answer the following questions.

- ▶▶ Does training in Life skills improve Self-regulated learning using concept mapping of students from eleventh standard?
- ▶▶ .Is there any significant difference between gender and self-regulated learning using concept mapping of students from eleventh standard?

##### Objectives

- ▶▶ To investigate the effectiveness of life skills training on self-regulated learning using concept mapping among eleventh standard students.
- ▶▶ To find out the significance difference between gender and self-regulated learning using concept mapping of eleventh standard students.

##### Hypotheses

- ▶▶ **H1:** There is no significant difference in Self-regulated learning using concept mapping among the pupils given 'Life-skills' training and who were not given the life skills training.
- ▶▶ **H2:** There is no significant difference in self-regulated learning using concept mapping of eleventh standard students owing to gender.

#### 5. METHODOLOGY

##### 5.1 Research Design

Two group post-test comparison designs were applied to investigate self-regulated learning of students from eleventh standard.

Groups	Treatment	Post-test
Experimental	X	O <sub>1</sub>
Control	-	O <sub>2</sub>

X-Intervention; O<sub>1</sub> and O<sub>2</sub>; post-test

##### 5.2 Sample

The sample consisted of 65 biology group eleventh standard students from Government Higher Secondary Schools in Chennai.

### 5.3 Tools

- ▶▶ Paul Pintrich's Motivated Strategies Learning Questionnaire (1991) and concept map has been used to measure self-regulated learning.
- ▶▶ Modules on Genetics based on Life skills was developed and standardized by the investigators. The reliability of the tools found to be 0.52 to 0.93 respectively.

### 5.4 Experimental Design

Two groups post-test comparison design has been followed to investigate the effectiveness of life skills on self-regulated learning using concept mapping. The present study consisted of one experimental and one control group and no pre-test was given for two groups. At the end of the training, post-test was applied for both groups simultaneously. The data for the present study have been collected from Government schools. Modules were prepared using the lesson 'Genetics' taken from the text book. The contents were designed by selecting life skills namely, communication, critical thinking, creative thinking and problem solving. Life skills are taught with different methodologies.

### 5.5 Assessment of self-regulated learning

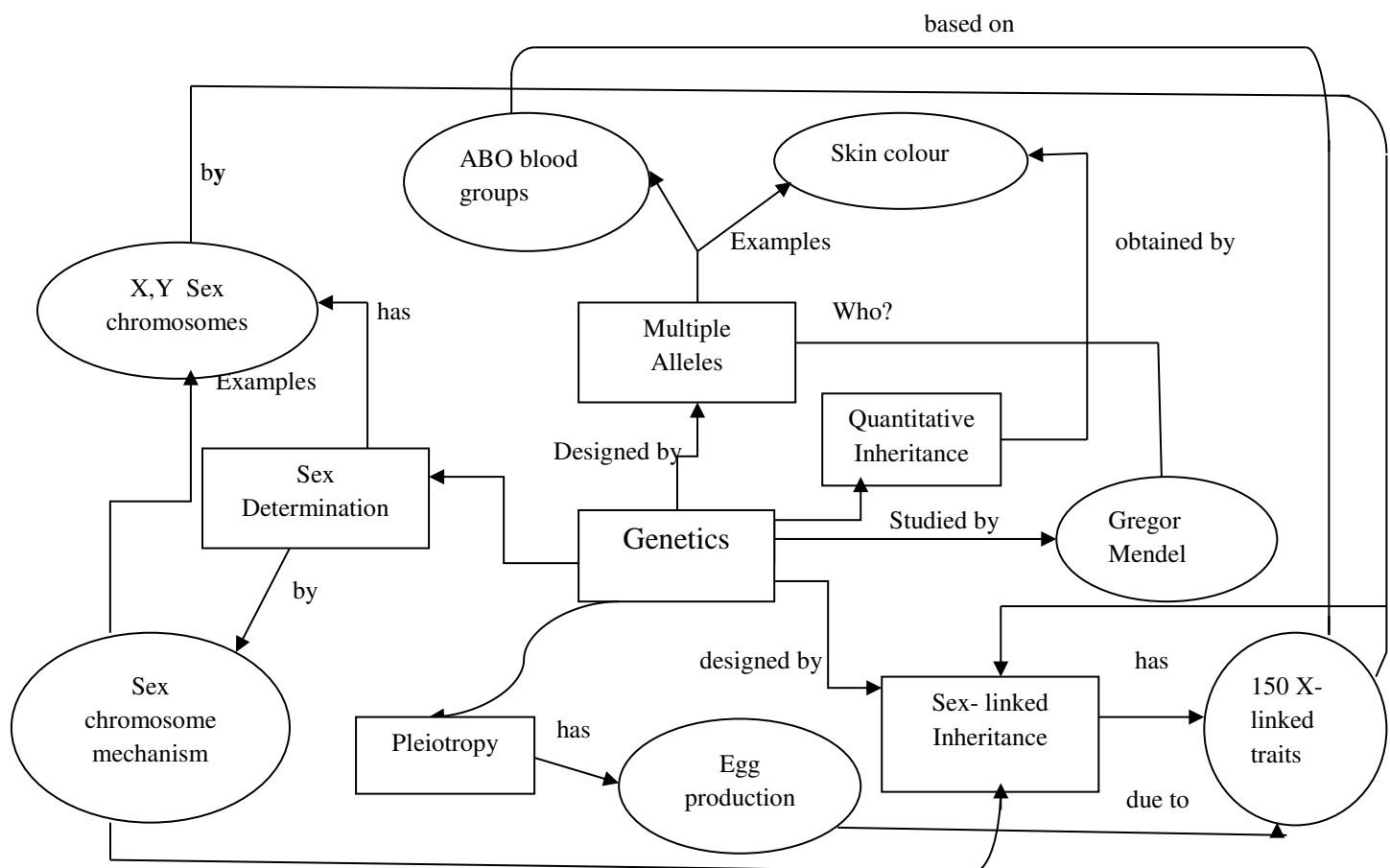


Figure 1: Concept mapping

The level of self-regulated learning of the students was measured by Concept mapping. The dimensions of self-regulated learning namely, Elaboration, Organization, Critical Thinking and Metacognitive self-regulation were adopted to draw concept mapping. The scoring for concept mapping of Genetics has been taken to measure self-regulated learning before and after treatment.

## 6. DATA ANALYSIS AND INTERPRETATION

### 6.1 Statistical Techniques

Mean, Standard Deviation and t-test are used to verify the hypotheses.

**Table- 1: Mean scores of self-regulated learning and concept- mapping of experimental and control groups**

Variables	Groups	N	Mean	Std. Deviation
Self-regulated learning	Experimental	33	468.24	51.054
	Control	32	447.34	61.963
	Total	65	457.95	57.217
Concept mapping	Experimental	33	7.12	1.193
	Control	32	3.09	0.995
	Total	65	5.14	2.304

### 6.2 Dependent Variable: Self-Regulated Learning Using Concept Mapping

The above table showed that the mean scores of Self-regulated learning and Concept mapping indicated that the ‘experimental group’ treated by life skills has scored better than the ‘control group’ treated by traditional method. It is concluded that life skills treatment is effective methodology for enhancing self-regulated learning among the students at all levels.

**Table 2 Critical Ratio of Gender in relation to Self-regulated learning using Concept mapping**

Gender	N	Mean	SD	Std. Er	df	t- value	Sig.
Male	32	5.88	1.963	0.347	63	2.655	p<0.05
Female	33	4.42	2.411	0.420			

Table 2 exhibited that there is significant difference among the students in self-regulated learning using concept mapping. The mean scores in self-regulated learning using concept mapping is found to be higher in males than female students where t-value is 2.655 with degrees of freedom 63 at 0.05 level.

### 6.3 Major Findings:

- ★ There is a significant difference in Self-regulated learning using concept mapping among the pupils given ‘Life-skills’ training and who are not given the life skills training.

- ★ There is a significant difference in self-regulated learning using concept mapping of eleventh standard students owing to gender. Male students secured higher level of self-regulated learning than female students.

## 7. EDUCATIONAL IMPLICATIONS:

The result of the present study emphasized that active engagement and life skills training promote self-regulated learning among the students.

The role of teacher is important for enhancing self-involvement of the learners. Activity based teaching and learning can be used by the teachers to develop self-regulation and it creates motivation to learn the content. Teachers should bring awareness about the importance of life skills and how it will be useful to reduce the negative aspects such as stress, confusion, exam anxiety and emotional imbalance on their learning process. Elimination of negative aspects leads to confidence, proper planning, control of emotion, monitor, active participation, curiosity and in their learning which turns into self-regulation. Management should encourage activity oriented learning which brings deviation from exam anxiety and make the students to learn in their own way. The roles of learners are the most important part to make self-regulation on their learning process. First they have to understand what is self-regulated learning and its benefits? how it is important for 21<sup>st</sup> century classroom? They have to deviate from usual type learning and whatever they are learning, plan and make innovative strategy themselves with the help of the teachers. It will reduce obstacles in self-learning. Students may also use some methodology to learn the content such as discuss with their peers and teachers, use some puzzles and odd words related to the subjects, make some questions and problems and find the answers, draw some pictures to know the key points from the lessons. When they learn themselves, they can shape their behaviour, avoid their bad habits, reduce their exam anxiety, develop their skills and time management to score good marks. They can also find their mistakes and analyse the reason to find the solution. These factors are necessary requirements for students to make them as a self-regulated learner who can easily achieve their academic success.

## 8. DISCUSSIONS AND CONCLUSION

The result of the present study showed that the students of experimental group students have scored better level of self-regulated learning than the students of control groups which agreed with (Adodo, 2013) who found that mind-mapping strategy as a Self-regulated Learning helped to improve students' performance in Biology. (Abbasi et al., 2014) addressed the use of concept maps in chemistry teaching which have a positive impact on the academic achievement and self-regulation learning. (Welch, 2009) examined that training of problem-solving skills is effective in self learning, self-monitoring, and self-discipline of students. (Khera, 2012) found that there is a positive correlation between Core Affective Life Skill and Self-Concept of adolescents which means that those who possessed these essential skills have confidence in all aspects.



The present study found that the male students have better level of self-regulated learning using concept mapping than female students which contradicted with (Morgan, 2013) who found that there was no significant difference in the extent of self-regulation, degree of cultural orientation and level of academic achievement due to gender. It may be concluded that self-regulated learning is an active and engagement process that requires a lot of practice, cognitive skills, training and different teaching and learning methodology. Life skills training have proved an appropriate methodology for reducing difficulties among the students in their learning process in order to develop self-regulated learning in the learning process.

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# Kinetics And Mechanism Of Oxidation Of 2, 6 Diphenyl-Piperidine-4-One And 3-Methyl 2, 6 Diphenyl-Piperidine-4-One By Manganese (VII) Ion

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## Abstract

*Kinetics of Oxidation of 2, 6 Diphenyl-Piperidine-4-one and Methyl 2, 6 Diphenyl-Piperidine-4-one by Mn(VII) in acidic medium reveals that kinetics order are the first order. The pseudo first order rate constant decreased on addition of manganese sulphate. The results are rational by a mechanism involving intermediate products. The following order of reactivity is observed 2, 6 Diphenyl-Piperidine-4-One & Methyl 2, 6 Diphenyl-Piperidine-4-One.*

## 1. INTRODUCTION

Kinetic studies on the oxidation of acids, cyclohexanol, allyl alcohol, dimethyl sulfoxide and substituted aniline by N-chloro-3-methyl-2, 6- diphenylpiperidine-4-one have been reported (1-5). Transition metal ions are widely used as oxidants both in synthetic organic and analytical chemistry. These metal ions are easily prepared and stored and their reaction can

be suitable controlled by the right choice of oxidants and reaction conditions. Among the transition elements such as *d* and *f* orbital involving various oxidation states [6, 7] partially form metal complexes. These transition metal ions by virtue of their d-orbital are capable of coordinating with a number of ligands depending on their electronic configuration [8]. The study of these metal complexes leads to a new dimension in chemistry, in association with industrial and chemical processes [9]. Manganese (VII) is the best known in the form of salt of the permanganate ion, which the potassium salt is by far the commonest. Mostly Manganese (VII) compound are tetrahedral (10). The mechanism of oxidation of 4-methyl hexanoic acid is analogous to that of the chronic acid oxidation of hydrocarbons involving initial abstraction of a hydrogen atom (11). The differential reactivity of the above substrate oxidation by Mn (VII) in acidic medium has been investigated. This was also useful in understanding the differential mechanistic pathways in these oxidations, nature of valence states and role of solvent (12). In the present work we have under taken Kinetics and mechanistic studies of oxidation 2, 6 Diphenyl-Piperidine-4-one and Methyl 2, 6 Diphenyl-Piperidine-4-one by Mn(VII) in acidic medium.

## 2. MATERIAL AND METHOD

2, 6 Diphenyl-Piperidine-4-one and 3-Methyl 2, 6 Diphenyl-Piperidine-4-one, BDH(AR) were prepared in double distilled water according to Balaish and Noller and used(13). Potassium permanganate -BDH (AR) was used without further purification. Sulphuric acid -BDH (AR) was used without further purification. Sodium sulphate -BDH (AR) was used without further purification. All other chemicals, acids and solvents used in the present work were of analytical reagent grade.

## 3. DETERMINATION OF STOICHIOMETRIES

Stoichiometries were determined by estimating the concentration of Mn(VII) in reaction samples by titration. The concentration of Mn(VII) was determined after knoen intervals of time in order to find out the stoichiometry as a function of time. The initial concentration of Mn(VII) was always determined before running into the stoichiometric samples. The stoichiometries was found to be 4:1 (oxidant ratio substrate) given in the table 1. Stoichiometry of piperiodone oxidation temperature 35<sup>0</sup>C,

$$\begin{aligned} I &= 1.8M & [\text{piperiodone}] &= 6 \times 10^{-5}M \\ [\text{Mn (VII)}] &= 6 \times 10^{-4}M & [\text{H}^+] &= 0.5M \end{aligned}$$

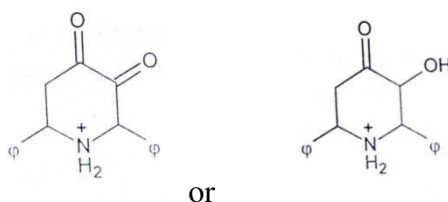
Table-1: oxidant ratio substrate

Time	$\frac{\Delta[\text{Mn(VII)}]}{\Delta[\text{Piperidine}]}$
18 hrs.30 min.	3.67
48 hrs.	4.40



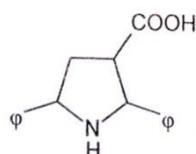
#### 4. PRODUCTS OF OXIDATION:

Intermediate products:



OR

The reaction always proceeded up to the stage where products like Observed in trace quantities through their methyl esters by GC.



#### Kinetics

For the kinetic measurements, the concentration of piperidone by kept 30 times higher than the concentration of Mn(VII). Concentration of piperidine varied from 0.01 M - 0.02M these measurements were carried out at three different acidities ranging from 0.03M - 0.05M keeping the ionic strength constant at 1.8 M by the addition of Sodium sulphate solution.

#### 5. RESULT AND DISCUSSION

Kinetics and mechanism of oxidation of 2, 6 diphenyl piperidine-4-one and 3- methyl 2, 6 - diphenyl pipridine- 4-one by Mn(VII) in acidic medium have been investigated. The plot of  $1 + \log \text{O.D}$  against time show a typical auto catalysed reaction with a conduction period.

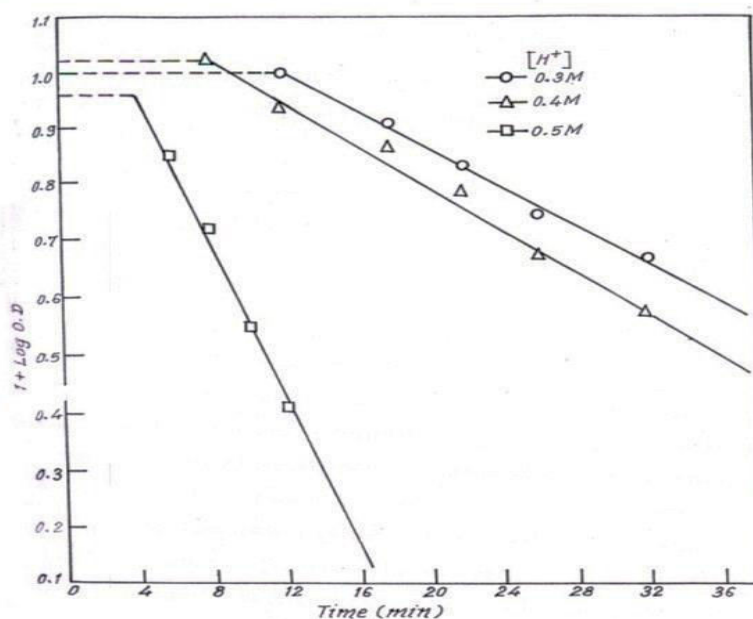


Figure 1: Plots of  $1 + \log \text{O.D.}$  against time for the oxidation of 2, 6 diphenyl piperidine-4-one with Mn (VII)

This has been formed to decrease with increasing temperature as well as acid concentration. This is indicative of coupled reaction where the intermediate has more reducing properties. Taking into account of the induction time for this autocatalysis, the  $1 + \log \text{OD}$  has redrawn for these observations which give a straight line.

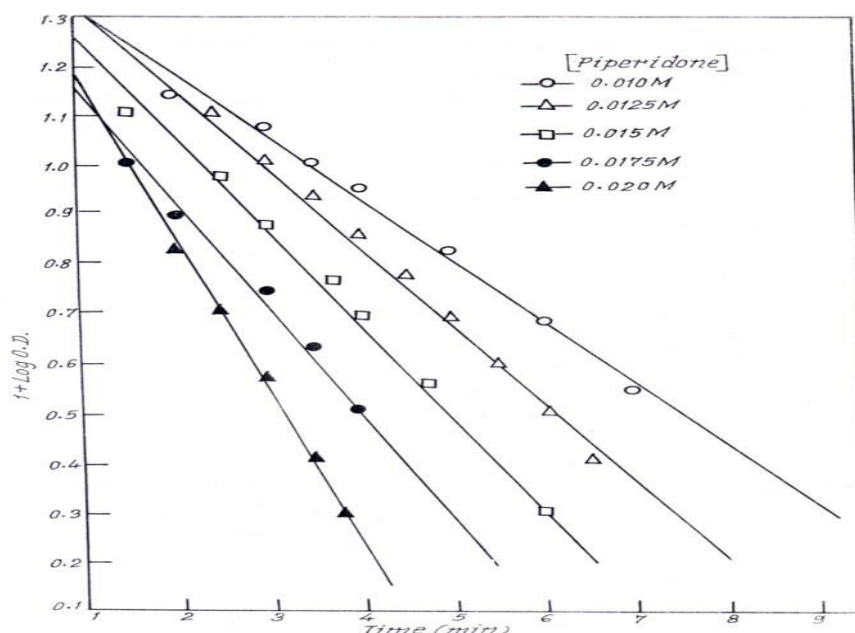


Figure 2a: Plots of  $1 + \log \text{O.D.}$  against time for 2, 6 diphenyl piperidine-4-one oxidation by  $\text{Mn (VII)}$  at  $55^\circ\text{C}$ ,  $I = 1.8\text{M}$ ,  $[\text{H}^+] = 0.5\text{M}$

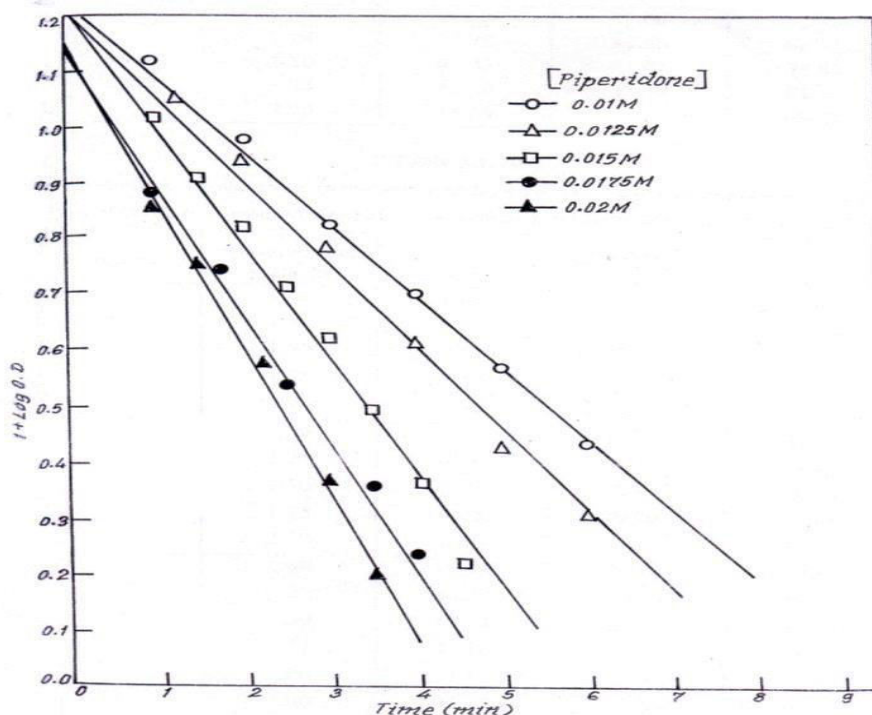


Fig.2b: Plots of  $1 + \log \text{O.D.}$  against time for 3-methyl-2, 6 diphenyl piperidine-4-one oxidation by  $\text{Mn (VII)}$  at  $55^\circ\text{C}$ ,  $I = 1.8\text{M}$ ,  $[\text{H}^+] = 0.5\text{M}$

**Table-2a:** Value of rate constants  $k_o \times 10^4 \text{ sec}^{-1}$  for the oxidation of 2, 6 diphenyl piperidine-4-one at  $I = 1.8 \text{ M}$  and  $[\text{Mn(VII)}] = 6 \times 10^{-4} \text{ M}$

Temp. °C	[piperidone] $\times 10^2 \text{ M}$	[H <sub>2</sub> SO <sub>4</sub> ] M		
		0.3	0.4	0.5
35	1.00	3.95	7.05	10.11
	1.25	5.13	6.02	13.30
	1.50	6.30	9.00	16.50
	1.75	4.47	10.00	19.65
	2.00	8.65	11.94	23.00
45	1.00	7.62	8.74	27.93
	1.25	10.50	12.32	33.05
	1.50	13.36	15.91	38.17
	1.75	16.23	19.50	43.30
	2.00	19.10	23.09	48.41
55	1.00	25.25	35.00	53.40
	1.25	32.78	38.43	66.11
	1.50	40.03	41.87	78.82
	1.75	47.30	45.30	91.53
	2.00	54.54	-	104.23

**Table-2b:** Value of rate constants  $k_o \times 10^4 \text{ sec}^{-1}$  for the oxidation of 3-methyl- 2, 6 diphenyl piperidine-4-one at  $I = 1.8 \text{ M}$  and  $[\text{Mn(VII)}] = 6 \times 10^{-4} \text{ M}$

Temp. °C	[piperidone] $\times 10^2 \text{ M}$	[H <sub>2</sub> SO <sub>4</sub> ] M		
		0.3	0.4	0.5
25	1.00	1.64	3.46	5.40
	1.25	2.57	4.38	6.13
	1.50	3.50	5.30	6.80
	1.75	4.42	6.26	7.47
	2.00	5.30	7.14	8.14
35	1.00	3.32	7.09	8.07
	1.25	4.56	7.82	14.40
	1.50	5.81	8.56	20.74
	1.75	7.05	9.30	27.08
	2.00	8.30	10.02	33.41
45	1.00	11.33	22.97	20.31
	1.25	15.28	26.23	25.50
	1.50	19.23	29.50	30.68
	1.75	23.18	32.76	35.86
	2.00	27.12	36.02	41.04
55	1.00	35.37	31.38	44.94
	1.25	38.30	37.75	59.05
	1.50	41.21	44.11	73.16
	1.75	44.13	50.48	87.27
	2.00	47.05	56.85	101.38

### I. Effect of varying concentration of oxidant on reaction rate:

The reaction is formed to be first order with respect to oxidant. The first order nature with respect to oxidant is confirmed from the constancy in the rate constant at different initial concentration of oxidant.

### 2, 6 diphenyl piperidine-4-one and 3-methyl- 2, 6 diphenyl piperidine-4-one

### II. Effect of varying concentration of piperidones

Inspection of the rate constant shows that the  $K_o$  value rise markedly with increasing concentration of piperidones. The plot of  $K_o$  against (piperidones) yield straight line (Fig. 3a, 3b) and hence the reaction is first order in (piperidones).

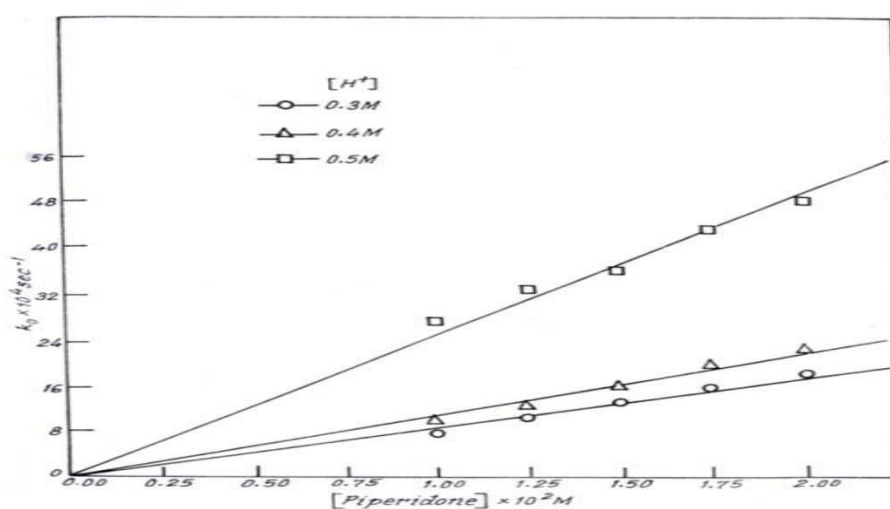


Figure 3a: Plots of  $K_{obs}$  against [2, 6 diphenyl piperidine-4-one] M at 45°C.

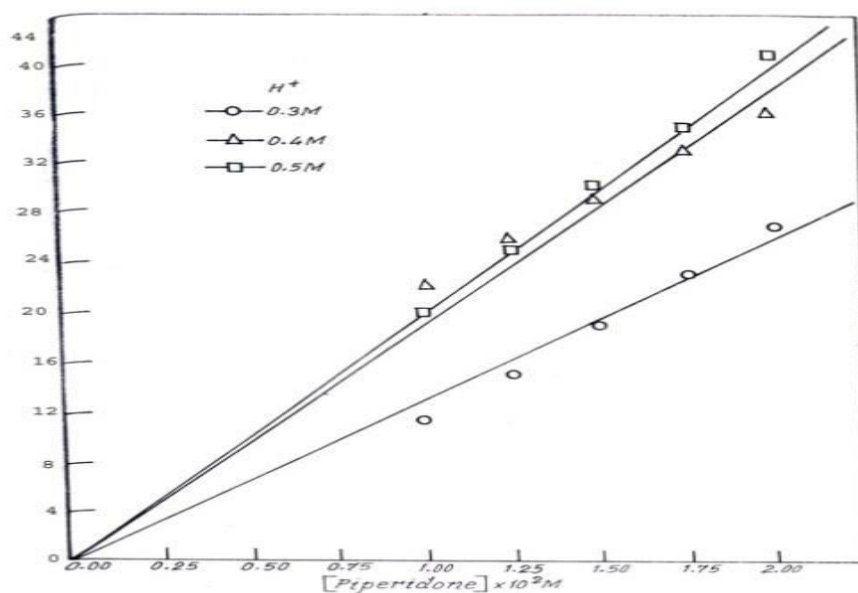


Figure 3b: Plots of  $K_{obs}$  against [3-methyl- 2, 6 diphenyl piperidine-4-one] M at 45°C



The bimolecular rate constant has been calculated from the slopes of these lines and is calculated in (Table 3a, 3b).

**Table-3a: Bimolecular rate constants  $K_0 \times 10^2 \text{ L M}^{-1} \text{ sec}^{-1}$  for the oxidation of 2, 6 diphenyl piperidine-4-one at  $I=1.8\text{M}$**

Temp. °C	[H <sub>2</sub> SO <sub>4</sub> ] M		
	0.3	0.4	0.5
25	2.6	3.60	3.70
35	2.94	4.98	20.72
45	11.67	13.04	25.00
55	15.79	25.47	56.43

**Table-3b: Bimolecular rate constants  $K_0 \times 10^2 \text{ L M}^{-1} \text{ sec}^{-1}$  for the oxidation of 3-methyl- 2, 6 diphenyl piperidine-4-one at  $I=1.8\text{M}$**

Temp. °C	[H <sub>2</sub> SO <sub>4</sub> ] M		
	0.3	0.4	0.5
35	4.69	3.89	12.78
45	11.48	14.35	20.47
55	13.74	29.02	50.83

There is no spectroscopic evidence for the formation of Mn(VII) piperidones complexes as no changes in the absorption spectrum of Mn(VII) on the addition of piperidones although slow changes of absorption occur due to oxidation.

### III. Effect of addition of Mn (II)

The pseudo first order rate constant decreased on addition of manganese sulphate. This is due to the fact that manganese sulphate reacts with per manganate ion to give intermediate manganese ion (II) (Table-4).

**Table-4: Effect of addition of Mn(II) on pseudo first order rate constants [piperidone]=0.01M; Tem. 55 °C; [H<sup>+</sup>]=0.5M [Mn(VII)] =  $6 \times 10^{-4} \text{ M}$ ;  $I=1.8\text{M}$ .**

[Mn (II)]M	$k_0 \times 10^3 \text{ sec}^{-1}$
0.001	7.67
0.003	7.10
0.005	6.65
0.008	6.39
0.01	5.66

The decrease in the rate with addition of Mn (II) could also mean that Mn (IV) is involved in the oxidation. The concentration of Mn(IV) is expected to decrease by addition of Mn(II)  
 $\text{Mn(III)} + \text{Mn(II)} \rightleftharpoons 2 \text{ Mn(IV)}$

### IV. Effect of varying concentration of acid on reaction rate:

The kinetics of oxidation of the substituted piperidones have been studied at various acidities i.e 0.3, 0.4 and 0.4 M (Table 3a and 3b).

The rate of reaction was found to increase with increase acid concentration the plot of overall bimolecular rate constant  $\log K_2 \text{ Vs } \log [\text{H}^+]$  which gives a linear plot (Fig. 4).

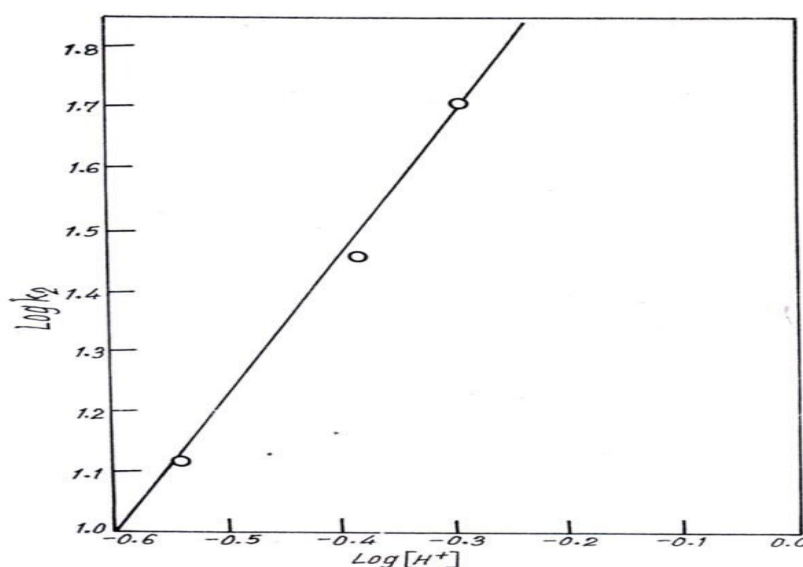
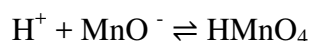


Figure 4: Plots of Log  $K_2$  against Log  $[H^+]$  for the oxidation of 2, 6 diphenyl piperidine-4-one with Mn(VII)

It appears that the active species is per manganic acid as per the equilibrium leading to unit dependence on acidity.



#### V. Effect of varying temperature on reaction rate

The oxidation rate of both 2-6 diphenyl piperidine-4-one and 3-methyl 2,6 diphenyl piperidine-4-one have been observed at various temperature i.e 25,35,45 and 55°C with increasing. The rate of reaction even found to increase temperature for all the substrate concentration at all acidities.

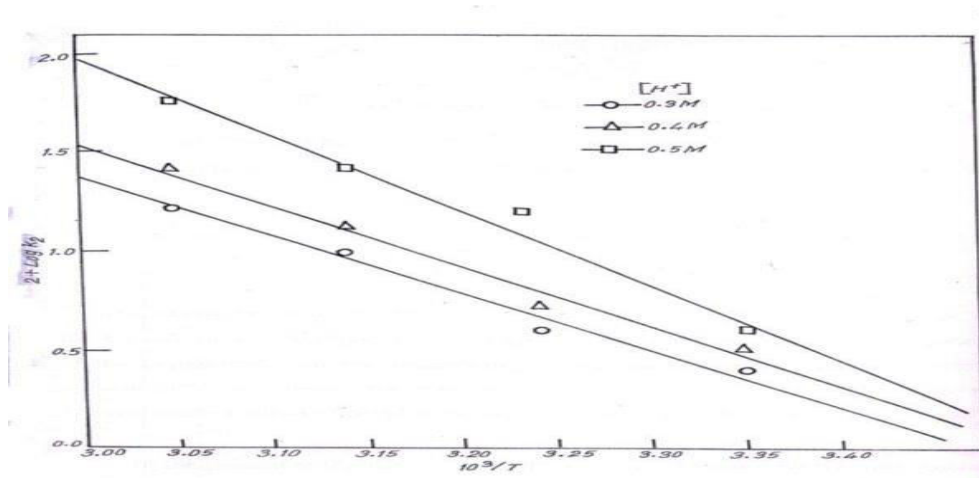
Table-5a: Values of activation parameters for the oxidation of 2, 6 diphenyl piperidine-4-one

$[H_2SO_4]$ M	$\Delta E_a$ kJ mole <sup>-1</sup>	$\Delta H^*$ kJ mole <sup>-1</sup>	$\Delta S^*$ JK <sup>-1</sup> mole <sup>-1</sup>	$\Delta G^*$ kJ mole <sup>-1</sup>
0.3	46.65±2.17	44.05±2.17	-95.76±7.26	83.22±4.33
0.4	74.57±1.58	72.00±1.55	-97.40±4.29	83.80±3.14
0.5	91.54±1.58	88.95±1.57	-34.40±5.47	80.80±3.14

Table-5b: Values of activation parameters for the oxidation of 3-methyl-2,6 diphenyl piperidine-4-one

$[H_2SO_4]$ M	$\Delta E_a$ kJ mole <sup>-1</sup>	$\Delta H^*$ kJ mole <sup>-1</sup>	$\Delta S^*$ JK <sup>-1</sup> mole <sup>-1</sup>	$\Delta G^*$ kJ mole <sup>-1</sup>
0.3	56.34±2.32	53.75±2.22	-131.08±7.03	84.44±4.44
0.4	56.38±1.32	53.84±1.32	-36.40±5.10	81.18±2.64
0.5	70.22±2.33	67.60±2.33	30.47±4.05	81.10±4.66

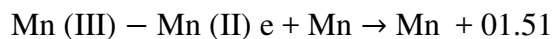
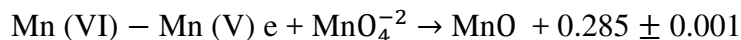
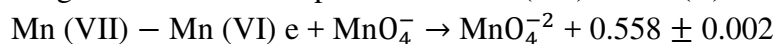
The activation parameter were calculated from the linear Arrhenius plot (Fig. 5a, 5b) of  $\log K_2 V_s T^{-1}$



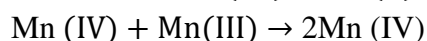
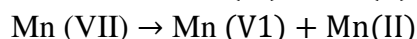
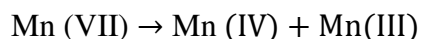
**Figure 5a: Arrhenius plots for 2,6 diphenyl piperidine-4-one oxidation**

#### Nature of oxidation state of Manganese:

Manganese exhibits a variable oxidation number. Oxidation state of Mn i.e +2,+4 and +7 are stable over wide range of acidity. In basic solution Mn (VI) and Mn (IV) are the main species of manganese. The overall potential of Mn (VII) to Mn (II) change is 1.51 V.

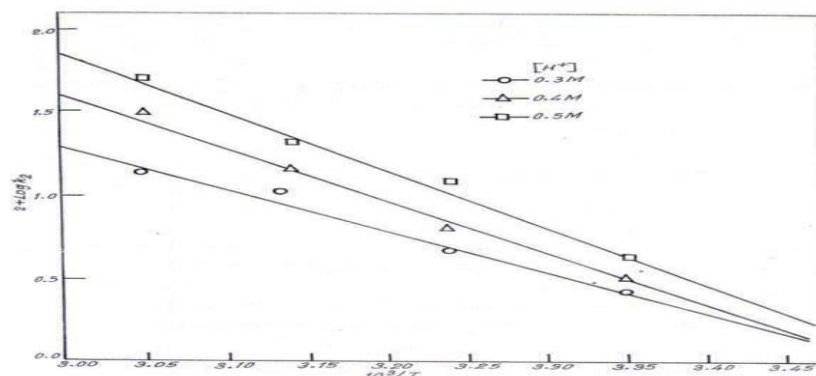


Mn (VII) oxidation can be explained according to the scheme.



Where, Mn (III) and Mn (IV) can be intermediate state.

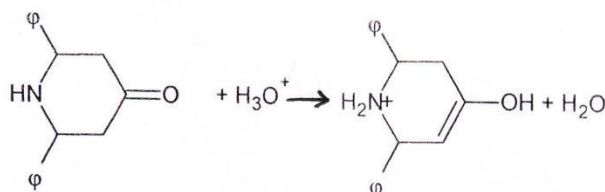
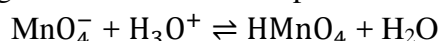
In the present investigation it appears that the rate of reaction is directly proportional to the acid concentration.



**Figure 5b: Arrhenius plots for 3-methyl-2,6 diphenyl piperidine-4-one oxidation**

### Rate law:

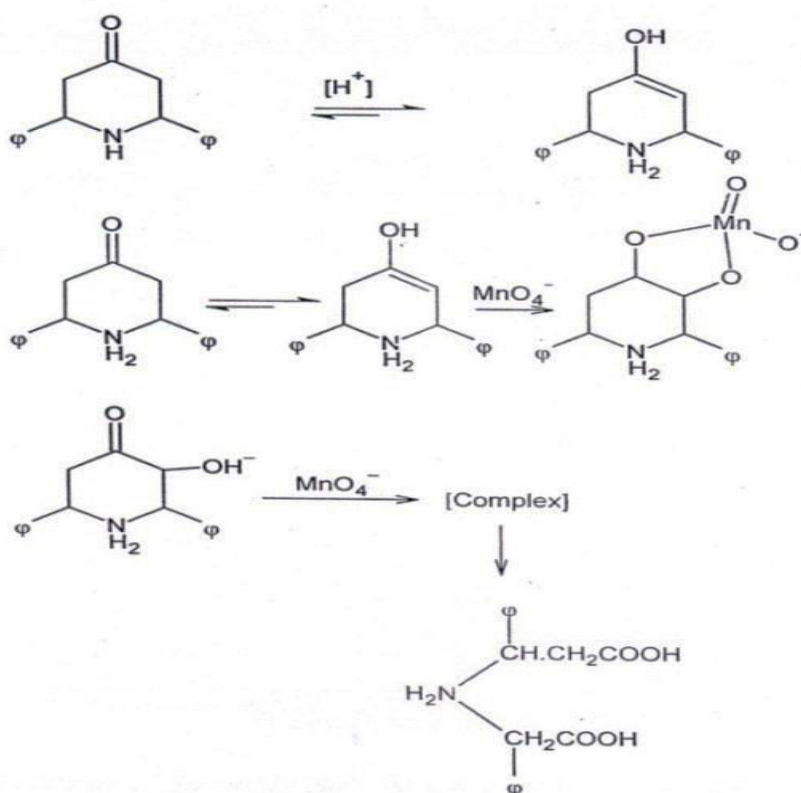
On the basis of experimental data given above the rate expression can be represented as:



$$\frac{d[\text{Mn(VII)}]}{dt} = k [\text{piperidone}] [\text{HMnO}_4] [\text{H}^+]$$

### 6. MECHANISTIC PATHWAY OF OXIDATION:

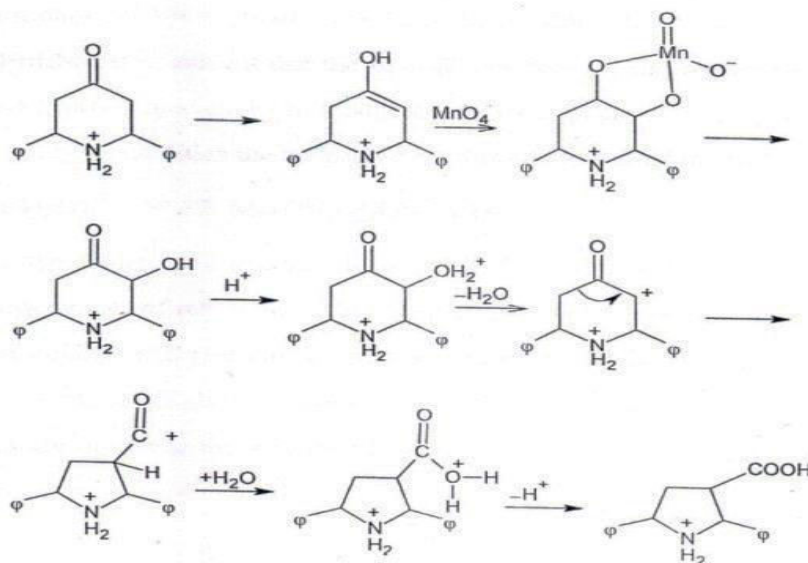
The inability to induce polymerization with methylmethacrylate rules out the formation of free radicals in the oxidation of 2, 6- diphenyl piperidine-4-one and 3-methyl-2,6- diphenyl piperidine-4-one with Mn(VII). This shows that the oxidation proceeds through the formation of cations from all the above facts the mechanism of piperidone with Mn(VII) can be given as-Product analysis through GC/MS shows that both the possibilities do occur in the formation of pyrrolidine-3- carboxylic acid or aminodicarboxylic acid.



Scheme-I

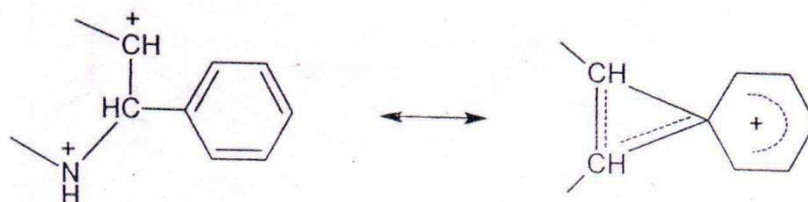


The more likely route for permanganate oxidation of piperidone will be scheme-II.



**Scheme-II**

Formation of permanganate cycle complex and cleaning of complex will require more energy compared to the promotion of the alcohol. The dehydration is facilitated by the stabilization of positive charge possible through a non-classical carbonium ion of the type.



## 7. COMPARISON OF THE OXIDATION RATE OF 2, 6- DIPHENYL PIPERIDINE-4-ONE AND 3-METHYL-2, 6- DIPHENYL PIPERIDINE-4-ONE

A comparison of the oxidation state of 2, 6- diphenyl piperidine with or without 3-alkyl substituent during the cause of oxidation with Mn(VII) reveals that the rate of oxidation of the former is higher than that of the 3-alkyl substituent (Table 6).

**Table-6: Rate constants for the oxidation of 2, 6- diphenyl piperidine-4-one and 3-methyl-2, 6- diphenyl piperidine-4-one by Mn(VII), Mn(IV) and Mn(III)**

[piperidone]	H <sub>2</sub> SO <sub>4</sub>	Oxidant		
		Mn(III)	Mn(IV)	Mn(VII)
2,6- diphenyl piperidine-4-one	0.3	32.5	49.5	16.0
	0.4	50.0	57.5	25.5
	0.5	61.3	71.0	56.5
3-methyl-2,6- diphenyl piperidine-4-one	0.3	19.0	32.0	14.0
	0.4	32.0	39.0	29.0
	0.5	41.0	60.0	51.0

In the present study the rate constant value is decreased by the introduction of methyl group at 3 positions in the piperidine ring system.

Table-7: Piperidone ring system

[piperidone]	H <sub>2</sub> SO <sub>4</sub>		
	0.3	0.4	0.5
2,6- diphenyl piperidine-4-one	16	25.5	56.5
3-methyl-2,6- diphenyl piperidine-4-one	14	29.0	51.0

## 8. CONCLUSION

The present investigation have been successful in the determining the mechanism of oxidation of substituted piperidones by Mn(VII) in the sulphuric acid medium. The acid permanganate seems to be the active species on case of Mn(VII) oxidation. The rate of oxidation for the substituted piperidones the order: 2, 6-di phenylpiperidine-4-one > 3 methyl 2, 6 di-phenyl piperidine - 4-one.

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# Analysis Of FM/M/1/N Queuing System With Reverse Balking And Reverse Reneging

Paper ID	IJIFR/V3/ E12/ 047	Page No.	4590-4597	Subject Area	Mathematics
Keywords	Reverse Reneging, Reverse Balking, Robust Ranking Technique, Fuzzy Numbers & Crisp Values				

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## Abstract

*In this paper the concept of reverse balking and reverse reneging for FM/M/1/N queuing system are considered which helps to find the expected system size ( $L_s$ ), Average rate of reverse reneging ( $R_r'$ ) and average rate of reverse balking ( $R_b'$ ) where they are expressed in terms of crisp value with fuzzy numbers. The queue discipline is FCFS. By considering the arrival rate, service rate, reverse balking and reverse reneging rate as trapezoidal fuzzy numbers, we convert all these fuzzy numbers into crisp values by using Robust Ranking Technique. Finally, the analytical results of the model are numerically illustrated for ( $R_r'$ ) and ( $R_b'$ ) under crisp environment for the different values of the parameters.*

## 1. INTRODUCTION

In queuing situations, the setup operations correspond to the preparatory work of the server before starting the service. In some actual situations, the server often requires a setup time before starting his each service period. Examining queuing systems which combine the N-policy with setup time, Baker [3] first proposed the N-policy M/M/1 queuing system with an exponential start-up time.

Now a day's customers have become more selective. Due to higher level of expectations customers get impatient more often with a particular firm. Customer impatience has become

a serious problem in the corporate world. Queuing theory offers various models that can be used in various service systems facing customer's impatience. Impatience generally takes three forms. The first is balking, deciding not to join the queue at all up on arrival; the second is reneging, the reluctance to remain in the waiting line after joining and waiting and the third is jockeying between lines when each of a number of parallel service channels has its own queue. For instance, the premier work on customer impatience in queuing theory appears in Haight [4,5], Anker and Gafarian [1,2], Baker [3] etc.,

The probability of balking will be low when the system size is more and vice-versa, which is balking in reverse order (called as Reverse Balking). Further, larger number of investors with an investment firm (insurance company, Mutual Fund Company, banks etc.,) creates trust among investors and let them complete the maturity term of their policies/bonds. That is, more the patience when larger is the number of investing customers with a firm. Viewing such a situation as a queuing system (purchase of policy is arrival, claim processing service) reflects that lesser will be reneging (impatience) when there are more number of customers in the system and vice-versa, which is reneging in reverse sense (called as Reverse Reneging). Hence the model is based on Markovian assumptions. Rakesh Kumar and Bhupender Kumar Som [10] developed and incorporate the concept of reverse balking and reverse reneging into the M/M/1/N queuing system.

We have many methods for converting fuzzy into crisp for which Robust Ranking technique is the most convenient method. By using this method we can convert fuzzy into crisp values. A general approach for queuing systems in a fuzzy environment based on zadeh's extension principle, which reduces fuzzy queue into family of crisp values is developed by Kao et al[8]. Fuzzy queues are potentially much more useful and realistic than the commonly used crisp queues. Li and Lee[9] investigated analytical results for two typical fuzzy queues FM/FM/1/ $\infty$ , M/F/1/ $\infty$  where F represents fuzzy time and FM represents fuzzified exponential distribution using zadeh's extension principle.

Many researchers like R.R.yager and S.P Chen[11] has discussed Ranking technique. Julia Rose Mary and Angel Jenitta [6] proposed the cost analysis for for bi-level threshold policy and single vacation of an unreliable server with fuzzy parameters. Recently Julia Rose Mary and Pavithra [7] discussed the analysis of FM/M(a,b)/1/MWV queuing model. With aid of the available literatures we study M/M/1/N queuing system with reverse balking and reverse reneging which is developed by Rakesh Kumar and Bhupender Kumar Som [10] in fuzzy environment.

## 2. MODEL DESCRIPTION

The queuing model is based on the following assumptions:

- (i) The arrival (purchase of insurance policy) is a Poisson process to a queuing system (insurance firm) occurs one by one in accordance with mean rate  $\lambda$  and the inter arrival times are exponentially distributed with parameter  $\lambda$ .



- (ii) There is a single server (claim processing department) and the policy claims are processed one by one and the service times are independently, identically and exponentially distributed with parameter  $\mu$ .
- (iii) The capacity of the system is finite, say  $N$ .
- (iv) The policy claims are processed in order of their arrival (i.e) the queue discipline is FCFS.
- (v) (a) When the system is empty (at the start of insurance business) customers balk (do not purchase policy) with probability  $q'$  and may purchase with probability  $p'(1 - q')$ .  
 (b) When there is at least one customer in the system, customers balk with a probability  $(1 - \frac{n}{N-1})$  and join the system with a probability  $\frac{n}{N-1}$ . Such a kind of balking is referred to reverse balking.
- (vi) The customers wait up-to certain time  $T$  and may leave the system before getting service due to impatience. The reneging time ( $T$ ) is independently, identically and exponentially distributed with parameter  $\eta$ .

With the help of these model descriptions we determine M/M/1/N queuing system with reverse balking and reverse reneging with fuzzy parameters.

Suppose the arrival rate  $\lambda$ , service rate  $\mu$ , reverse balking rate  $q'$  and reverse reneging rate  $\eta$  are approximately known and can be represented as fuzzy set  $\bar{\lambda}$ ,  $\bar{\mu}$ ,  $\bar{q}$  and  $\bar{\eta}$  where,

$$\bar{\lambda} = \{t, \theta_{\bar{\lambda}}(t)/t \in S(\bar{\lambda})\}, \bar{\mu} = \{x, \theta_{\bar{\mu}}(x)/x \in S(\bar{\mu})\},$$

$$\bar{q} = \{y, \theta_{\bar{q}}(y)/y \in S(\bar{q})\} \text{ and } \bar{\eta} = \{u, \theta_{\bar{\eta}}(u)/u \in S(\bar{\eta})\}.$$

Here  $\theta_a(b)$  and  $S(a)$  denote the membership function and support of  $a$  where  $a = \bar{\lambda}, \bar{\mu}, \bar{q}, \bar{\eta}$  are fuzzy numbers and  $b = t, x, y, u$  are the crisp values corresponding to arrival rate, service rate, reverse balking rate and reverse reneging rate respectively.

On the basis of the concept of  $\alpha$ -cut we develop a mathematical programming approach for deriving the  $\alpha$ -cuts for  $\bar{\lambda}, \bar{\mu}, \bar{q}, \bar{\eta}$  as crisp intervals which are given by

$$\bar{\lambda}(\alpha) = \{t \in T / \theta_{\bar{\lambda}}(t) \geq \alpha\}, \quad \bar{\mu}(\alpha) = \{x \in X / \theta_{\bar{\mu}}(x) \geq \alpha\}, \quad \bar{q}(\alpha) = \{y \in Y / \theta_{\bar{q}}(y) \geq \alpha\}, \quad \bar{\eta}(\alpha) = \{u \in U / \theta_{\bar{\eta}}(u) \geq \alpha\}$$

where  $0 < \alpha \leq 1$ . Hence a fuzzy queue can be reduced to a family of crisp queues with different  $\alpha$ -cuts  $\{\lambda(\alpha)/0 < \alpha \leq 1\}, \{\mu(\alpha)/0 < \alpha \leq 1\}, \{q'(\alpha)/0 < \alpha \leq 1\}$  and  $\{\eta(\alpha)/0 < \alpha \leq 1\}$ .

Let the confidence interval of the fuzzy sets  $\lambda(\alpha), \mu(\alpha), \mu_v(\alpha)$  and  $\eta(\alpha)$  be  $[l_{\lambda}(\alpha), u_{\lambda}(\alpha)], [l_{\mu}(\alpha), u_{\mu}(\alpha)], [l_{\eta}(\alpha), u_{\eta}(\alpha)]$  and  $[l_{\eta}(\alpha), u_{\eta}(\alpha)]$  according to the classical M/M/1/N model with reverse balking and reverse reneging, the expected system size ( $L_s$ ) is given by (fuzzy environment)

$$L_s = \frac{nA + NB}{1 + A + B}$$

where  $A = \left[ \sum_{n=1}^{N-1} \left\{ \frac{(n-1)!}{(N-1)^{n-1}} \prod_{i=1}^{N-1} \frac{\lambda}{\mu + [N - (r-1)]\eta} \right\} \right] p$ ,

$B = \left[ \frac{(n-1)!}{(N-2)^{N-2}} \prod_{i=1}^N \frac{\lambda}{\mu + [N - (r-1)]\eta} \right] p$ .

By applying the fuzzy variable for arrival rate, service rate, reverse balking and reverse reneging parameter we get,

Average rate of reverse reneging ( $R'_r$ ) is given by,

$$R'_r = \frac{\{N - (n-1)\}uA + uB}{1 + A + B}$$

Also the average rate of reverse balking ( $R'_b$ ) is given by,

$$R'_b = \frac{yt + \left(1 - \frac{n}{(N-1)}\right)tA}{1 + A + B}$$

where A is given by  $\left[ \sum_{n=1}^{N-1} \left\{ \frac{(n-1)!}{(N-1)^{n-1}} \prod_{i=1}^{N-1} \frac{t}{x + [N - (r-1)]u} \right\} \right] p$ ,

and B =  $\left[ \frac{(n-1)!}{(N-2)^{N-2}} \prod_{i=1}^N \frac{t}{x + [N - (r-1)]u} \right] p$ .

### 3. ROBUST RANKING TECHNIQUE

Crisp value can be found by using the most successful technique called Robust Ranking. To find the system characteristics in terms of crisp value we defuzzify the number into crisp ones by a fuzzy number ranking method. By giving a convex fuzzy number 'a', the Robust Ranking index is defined by,

$$R(\bar{a}) = \int_0^1 0.5(a_\alpha^L + a_\alpha^U) d\alpha \text{ where } (a_\alpha^L + a_\alpha^U) \text{ is the } \alpha\text{-level cut of the fuzzy number } \bar{a}. \text{ In}$$

this paper we use Robust Ranking method for ranking the fuzzy numbers. The Robust Ranking index  $R(\bar{a})$  gives the representative value of the fuzzy number  $\bar{a}$ , which satisfies the linearity and additive property.

### 4. Numerical Example

To study the effect of parameter on the system characteristics, Numerical evaluation is performed and the various results are displayed with graphs.

Consider FM/M/1/N with reverse balking and reverse reneging. The corresponding parameters such as arrival rate, service rate, reverse balking and reverse reneging parameter are fuzzy numbers. By letting  $\lambda = [0.2, 0.3, 0.4, 0.5]$ ,  $\mu = [0.1, 0.15, 0.2, 0.25]$ ,

$q' = [0.09, 0.19, 0.29, 0.39]$  and  $\eta = [0.01, 0.02, 0.03, 0.04]$  whose intervals of confidence are  $[0.2+\alpha \ 0.5-\alpha]$ ,  $[0.05+\alpha \ 0.35-\alpha]$ ,  $[0.09+\alpha \ 0.39-\alpha]$  and  $[0.01+\alpha \ 0.04-\alpha]$  respectively. The membership function of the trapezoidal fuzzy number (0.2, 0.3, 0.4, 0.5) is given by

$$\theta(p) = \left\{ \frac{p-0.2}{0.1}, \ 0.2 \leq p \leq 0.3, \ 0.2, \ 0.3 \leq p \leq 0.4, \ \frac{0.5-p}{0.1}, \ 0.4 \leq p \leq 0.5, \ 0 \text{ Otherwise.} \right\}$$

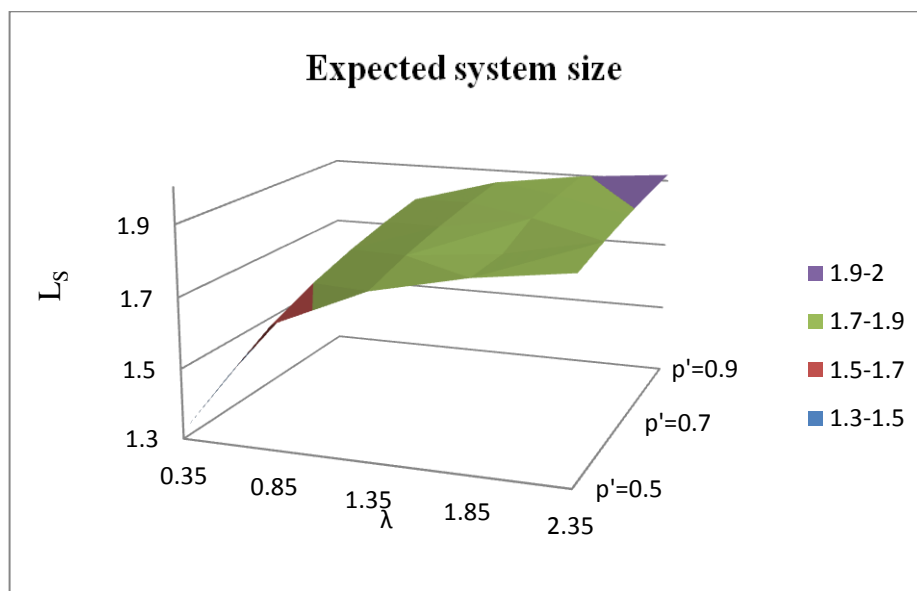
The  $\alpha$ -cut of the fuzzy numbers (0.2, 0.3, 0.4, 0.5) is  $(0.2+0.1\alpha, 0.5-0.1\alpha)$  for which

$$R(\bar{\lambda}) = R(0.2, 0.3, 0.4, 0.5) = \int_0^1 0.5(0.2 + 0.5) = \int_0^1 0.5(0.7) = 0.35. \text{ By substituting the above values}$$

the expected system size for FM/M/1/N with reverse balking and reverse reneging are tabulated.

**Table 1: Expected System size for FM/M/1/N with reverse balking and reverse reneging Model**  
 $\mu=0.2, N=3, r=3, p'=0.5$

$\lambda$ $p'$	0.35	0.85	1.35	1.85	2.35
0.5	1.3209	1.6505	1.7647	1.8227	1.8577
0.6	1.3999	1.7	1.8	1.825	1.880
0.7	1.4627	1.7372	1.8267	1.87	1.8963
0.8	1.5134	1.7662	1.8462	1.8854	1.9086
0.9	1.556	1.7895	1.8621	1.8974	1.9184



**Figure 1 :  $L_s$  versus  $(\lambda, p')$**

From the table(1) and Figure(1), it is found that the expected system size increases with increase in rate of arrival. Also, we find that the expected system size increases when the purchase rate increases. We note that the above information is very useful for designing the fuzzy queuing system.

The average rate of reverse reneging is given by the formulae,

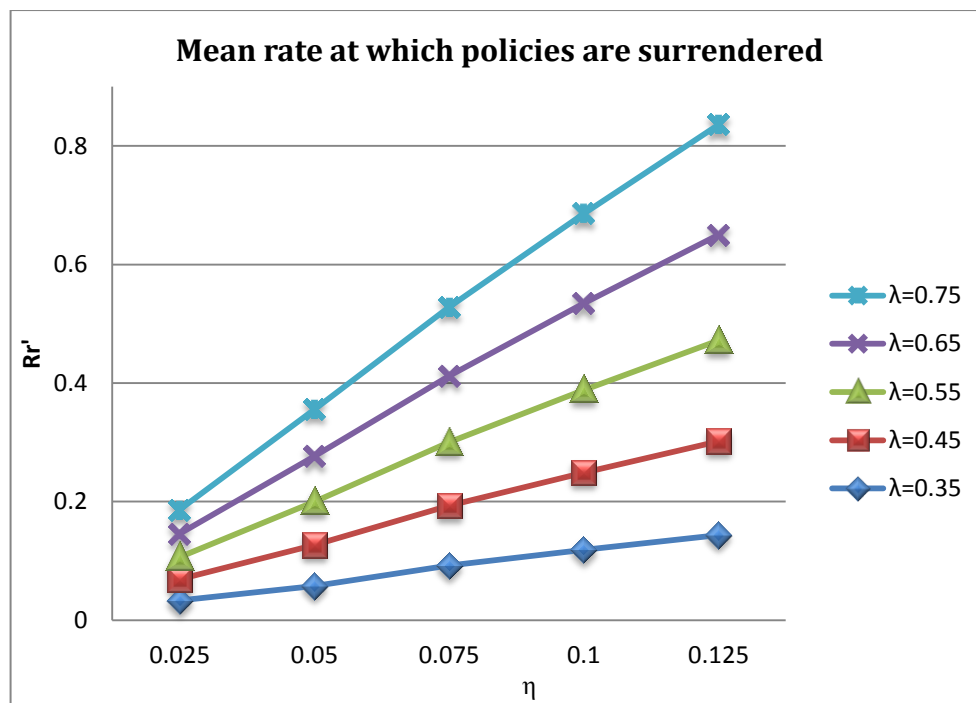
$$R'_r = \frac{\{N-(n-1)\}\eta A + \eta B}{1+A+B}$$

where  $A = \left[ \sum_{n=1}^{N-1} \left\{ \frac{(n-1)!}{(N-1)^{n-1}} \prod_{i=1}^{N-1} \frac{\lambda}{\mu + [N-(r-1)]\eta} \right\} p' \right]$  and  $B = \left[ \frac{(n-1)!}{(N-2)^{N-2}} \prod_{i=1}^N \frac{\lambda}{\mu + [N-(r-1)]\eta} \right] p'$

By computation, we choose arbitrarily the parameters  $\lambda = 0.35, \mu = 0.2, q' = 0.5, \eta = 0.025, N = 3, r = 3, p' = 0.5$  that satisfy the stability condition. Here the average rate of reverse reneging is evaluated for different values of  $\lambda$  and  $\eta$ . Then the values are tabulated and shown in the figure, by using the above formula.

**Table 2: Average rate of Reverse Reneging**

$\lambda \backslash \eta$	0.025	0.05	0.075	0.1	0.125
0.35	0.033	0.0573	0.0921	0.1186	0.1434
0.45	0.0357	0.0692	0.1008	0.1304	0.1585
0.55	0.0377	0.0733	0.1071	0.1392	0.1698
0.65	0.0392	0.0765	0.1121	0.1461	0.1786
0.75	0.0403	0.0789	0.1159	0.1515	0.1856



**Figure 2:  $R'_r$  versus  $(\eta, \lambda)$**

From the table (2) and figure(2) we conclude that average rate of reverse reneging increases for increasing at the rate of arrival and also increases when the reneging rate increases.



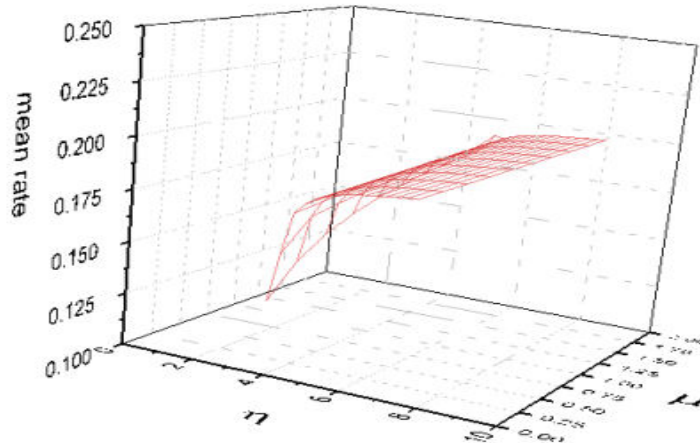
Moreover, average rate of reverse balking is evaluated by using the formulae,

$$R'_b = \frac{q'\lambda + (1 - \frac{n}{N-1})\lambda A}{1+A+B} \quad \text{where } A = \left[ \sum_{n=1}^{N-1} \left\{ \frac{(n-1)!}{(N-1)^{n-1}} \prod_{i=1}^{N-1} \frac{\lambda}{\mu + [N - (r-1)]\eta} \right\} \right] p'$$

$$\text{and } B = \left[ \frac{(n-1)!}{(N-2)^{N-2}} \prod_{i=1}^N \frac{\lambda}{\mu + [N - (r-1)]\eta} \right] p'$$

**Table 3: Average rate of Reverse Balking**

$\eta \backslash \mu$	0.025	0.775	1.525	2.275	3.025	3.775	4.525	5.275	6.025	.....	9.025	9.775	10.525
0.2	0.106	0.132	0.154	0.159	0.163	0.165	0.166	0.167	0.168	.....	0.170	0.171	0.171
0.4	0.122	0.147	0.156	0.160	0.163	0.165	0.166	0.168	0.168	.....	0.170	0.171	0.171
0.6	0.132	0.149	0.157	0.161	0.164	0.166	0.167	0.168	0.169	.....	0.170	0.171	0.171
0.8	0.139	0.152	0.158	0.162	0.164	0.166	0.166	0.168	0.169	.....	0.171	0.171	0.171
1	0.144	0.154	0.159	0.163	0.165	0.166	0.167	0.168	0.169	.....	0.171	0.171	0.171
1.2	0.147	0.156	0.160	0.163	0.165	0.167	0.168	0.168	0.169	.....	0.171	0.171	0.171
1.4	0.150	0.157	0.161	0.164	0.166	0.167	0.168	0.169	0.169	.....	0.171	0.171	0.171
1.6	0.153	0.159	0.162	0.164	0.166	0.167	0.168	0.169	0.169	.....	0.171	0.171	0.171
1.8	0.155	0.159	0.163	0.165	0.166	0.167	0.168	0.169	0.169	.....	0.171	0.171	0.171
2	0.156	0.165	0.163	0.165	0.167	0.168	0.168	0.169	0.169	.....	0.171	0.171	0.172



**Figure 3:  $R'_b$  versus  $(\eta, \mu)$**

From the table(3) and figure(3), it is clear that average rate of reverse balking increases with the reverse reneging rate  $\eta$  and increases as the service rate increases.

## 5. CONCLUSION

In this paper the concept of reverse balking and reverse reneging is incorporated into an FM/M/1/N queuing system. The arrival rate, service rate, reverse balking and reverse reneging rate are fuzzy number. Further the fuzzy problem has been converted into crisp

problem by using Robust Ranking Technique. Thus by applying the R.R.T, we find that the expected system size ( $L_s$ ) increases with respect to arrival rate and for purchase rate. Also we notice that, the reverse reneging rate ( $R'_r$ ) which increases with respect to arrival and reverse reneging. Further, the reverse balking ( $R'_b$ ) which increases with respect to reverse reneging and also with service rate. Moreover, the efficient results are also verified graphically.

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# Direct Utilization of Wind Energy

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Reverse Reneging, Reverse Balking, Robust Ranking Technique, Fuzzy Numbers &amp; Crisp Values

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## Abstract

*Wind energy is the fastest growing source of energy and is getting worldwide attention due to the technological advances for harnessing the wind power and its competitive cost of production compared to other traditional means. Wind turbines are used in many places of the world. In most of the cases, it is fitted with a generator to convert mechanical energy to electrical energy and batteries to store electrical energy. But lots of energy losses will occur due to conversions and also, more money is required. In order to avoid these problems, the wind power utilization is restricted to pumping of water in to a tank. But many times the tank will be full and energy will be wasted. Hence in this project, it is directly used to do mechanical work for polishing materials to get good surface finish.*

## 1. INTRODUCTION

Mainly there are two types of wind turbines.

- i. Horizontal Axis Wind Turbine (HAWT) and
- ii. Vertical axis Wind turbine (VAWT)

### 1.1 Horizontal Axis Wind Turbine:

Horizontal-axis wind turbines (HAWT) have the main rotor shaft and electrical generator at the top of a tower, and must be pointed into the wind. Most have a gearbox, which turns the slow rotation of the blades into a quicker rotation that is more suitable to drive an electrical generator. Since a tower produces turbulence behind it, the turbine is usually pointed upwind of the tower. Turbine blades are made stiff to prevent the blades from being pushed into the tower by high winds. Additionally, the blades are placed a considerable distance in front of the tower and are sometimes tilted up a small amount. Downwind machines have

been built, despite the problem of turbulence, because they don't need an additional mechanism for keeping them in line with the wind, and because in high winds the 3 blades can be allowed to bend which reduces their swept area and thus their wind resistance.

#### **1.11 Advantages of HAWT:**

- Variable blade pitch, which gives the turbine blades the optimum angle of attack. Allowing the angle of attack to be remotely adjusted gives greater control, so the turbine collects the maximum amount of wind energy for the time of day and season.
- The tall tower base allows access to stronger wind in sites with wind shear. In some wind shear sites, every ten meters up, the wind speed can increase by 20% and the power output by 34%.
- High efficiency, since the blade always moves perpendicularly to the wind, receiving Power through the whole rotation. In contrast, all vertical axis wind turbines, and most proposed airborne wind turbine designs, involve various types of reciprocating actions, requiring air foil surfaces to backtrack against the wind for part of the cycle. Backtracking against the wind leads to inherently lower efficiency.

#### **1.12 Disadvantages HAWT:**

- The tall towers and blades up to 90 meters long are difficult to transport. Transportation can now cost 20% of equipment costs.
- Tall HAWTs are difficult to install, needing very tall and expensive cranes and skilled operators.
- Massive tower construction is required to support the heavy blades, gearbox, and generator.
- Reflections from tall HAWTs may affect side lobes of radar installations creating signal clutter, although filtering can suppress it.
- Downwind variants suffer from fatigue and structural failure caused by turbulence when a blade passes through the tower's wind shadow (for this reason, the majority of HAWTs use an upwind design, with the rotor facing the wind in front of the tower).
- HAWTs require an additional yaw control mechanism to turn the blades toward the wind.

#### **1.2 Vertical Axis Wind Turbines:**

Vertical-axis wind turbines (VAWT) have the main rotor shaft arranged vertically. Key advantages of this arrangement are that the turbine does not need to be pointed into the wind to be effective. This is an advantage on sites where the wind direction is highly variable. VAWTs can utilize winds from varying directions. With a vertical axis, the generator and gearbox can be placed near the ground, so the tower doesn't need to support it, and it is more accessible for maintenance. Drawbacks are that some designs produce pulsating torque. Drag



**Figure 1: Vertical axis wind turbine**



may be created when the blade rotates into the wind.

#### 1.21 Advantages of VAWT

- A massive tower structure is less frequently used, as VAWTs are more frequently mounted with the lower bearing mounted near the ground.
- Designs without yaw mechanisms are possible with fixed pitch rotor designs.
- A VAWT can be located nearer the ground, making it easier to maintain the moving parts.
- VAWTs have lower wind start up speeds than HAWTs. Typically, they start creating electricity at 6 M.P.H. (10 km/h).
- VAWTs may have a lower noise signature.

#### 1.22 Disadvantages of VAWT

- Most VAWTs produce energy at only 50% of the efficiency of HAWTs in large part because of the additional drag that they have as their blades rotate into the wind.
- While VAWTs' parts are located on the ground, they are also located under the weight of the structure above it, which can make changing out parts nearly impossible without dismantling the structure if not designed properly.
- Having rotors located close to the ground where wind speeds are lower due to wind shear, VAWTs may not produce as much energy at a given site as a HAWT with the same footprint or height.

Considering all the above aspects, VAWT is selected for the experiment because of the main thing of not requiring adjustments for change in direction of the wind.

## 2. DESCRIPTION OF THE EQUIPMENT

### 2.1 Main Structure:

The arrangement is shown in fig 2. The main structure which is made by steel angles and it is a skeleton has it holds the bearings. Mild steel is used as material for work table. Height of the table is 700mm. upper dimensions are 300mmx300mm. Distance between bearing frame is 100mm.

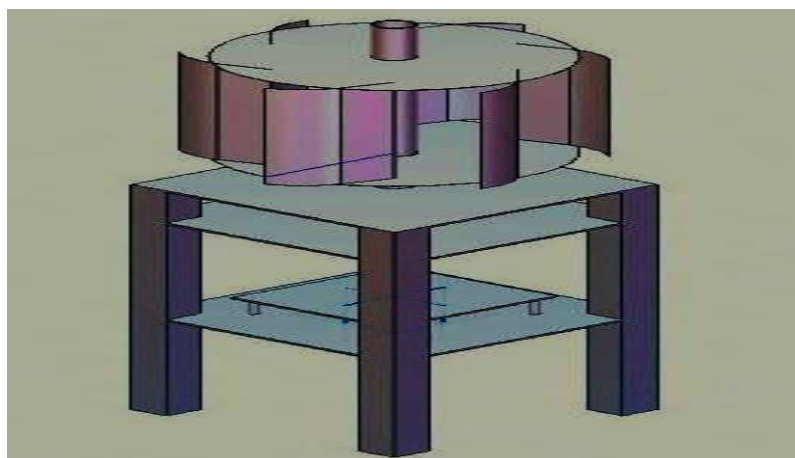


Figure 2: 3D drawing of the arrangement

## 2.2 Bearing:

For our particular setup we used deep groove ball bearings that are going to primarily centralize the shaft, and a turntable bearing to take the majority of the weight. This combination will provide the least amount of friction, while maximizing bearing life and maintaining safe operating conditions.



**Figure 3: Bearing**

## 2.3 Shaft.

The Shaft is selected as Aluminium pipe which is vertical placed, which supports wind turbine and abrasive disc tool. It is shown in figure 4



**Figure 4: Shaft**

## 2.4 Blades

The blades shown in the fig.5 are six blades and are curved. These types of blades are selected to know that whether it will work or not. 6 blades are used vertically, at an angle of 45deg with respect to horizontal axis. Actually the blades are fabricated by Aluminium sheets.



**Figure 5: Turbine blades.**

### 2.5 Work Holding Table:

Work holding table holds the work piece which is to be finished, and it is forced to the tool using spring system. It is shown in the figure 6.



**Figure 6: Work holding table.**

### 2.6 Abrasive Disc Tool:

It is a round disc of 50 mm diameter abrasive tool. Help in removing material. It is shown in figure 7.



**Figure7: Abrasive Tool.**

## 3. EXPERIMENTAL SETUP AND WORKING:

The experimental setup is shown in figure 8. Working principle of the surface finishing machine fabricated is basically simple, as wind flows through the wind turbine it rotate the turbine, which in turn rotates the abrasive tool. And work piece is moved up by spring system and brought in contact to it and then the material is removed.





**Figure 8: The experimental setup**

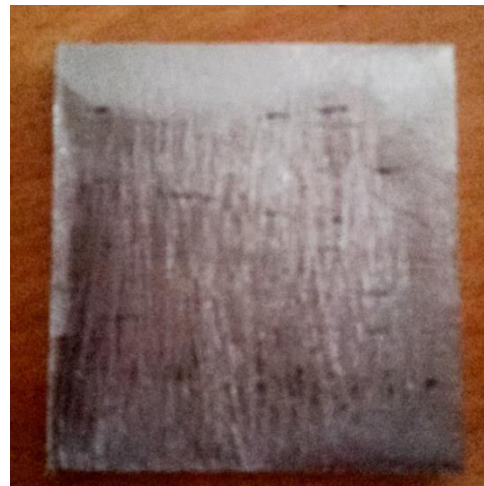
As we know that the wind intensity or distribution is low in the experimentation location. So we had used table fan. When table fan placed in front of wind turbine as an artificial source which causes the wind turbine to rotate, based on this we can obtain results. And the result is obtained with respect to time.

#### 4. EXPERIMENTAL RESULT AND DISCUSSION

The work piece selected for experimental work was a 40mm square mild steel piece with 6mm thickness. Figure-9a shows the work piece before surface finishing and figure-9b shows that after surface finishing.



**Figure-9a**



**Figure-9b**

The experimental results for different thicknesses of material removal and time requirements are given in the table-1. The probable time for indirect utilisation using Dynamo- battery- motor method is also given for comparison.



Table-1: Different thicknesses of material removal and time requirements

Sl. No.	Thickness of material removed (in mm)	Approximate time taken(in minutes)	
		For direct utilisation	For Dynamo- battery motor method
1	0.05	8	16
2	0.10	15	30
3	0.15	22	44
4	0.20	30	60

The above results are plotted as shown in figure-9. It also shows the comparison between direct method and indirect method.

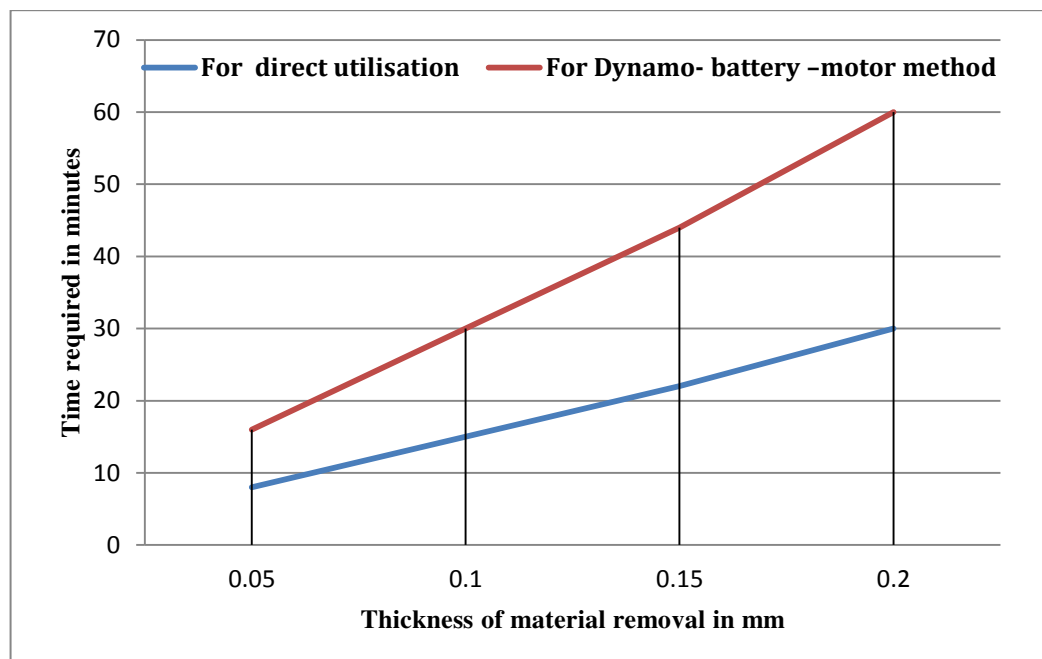


Figure-9: Time required for different material removable thicknesses

The graph shows that time required is directly proportional to the thickness of the material removed. With direct method of utilisation, the time taken is one half of that of indirect method of Dynamo-battery-motor method because the overall efficiency of the system is the product of dynamo efficiency (0.8), battery efficiency(0.8) and motor efficiency(0.8). That is  $0.8 \times 0.8 \times 0.8 = 0.51$

## 5. CONCLUSION

It is concluded that the wind energy can be directly utilized to do surface finishing or any such mechanical operations like turning, milling and so on. Also, with little automation, we can make the raw materials to move automatically one after the other in to the equipment and finished products can be collected at the outlet of the machine. Direct utilisation is more efficient and less costly compared to indirect method of utilisation.

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# Secured Wireless Sensor Network With Mobile Sinks And Key Pre-Distribution For Disaster Recovery In Petrochemical Industry

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Security; Encryption, Visual steganography, Image slicing

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## Abstract

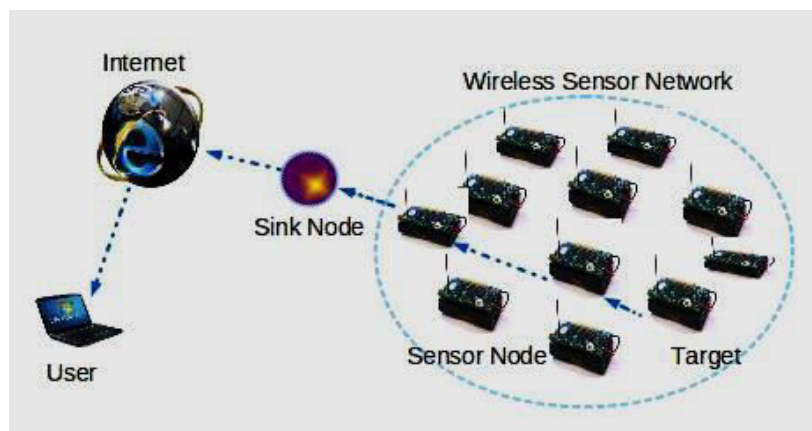
Modern society consumes large amounts of fuel, and the petroleum industry is a crucial part of the infrastructure and maintenance of society in almost all countries. The petroleum industry is one of the world's largest industries. An oil platform, offshore platform, or oil rig is a large structure with facilities to drill wells, to extract and process oil and natural gas, or to temporarily store product until it can be brought to shore for refining and marketing. In many cases, the platform contains facilities to house the workforce as well. To monitor disasters in rigs, wireless sensor networks are used with mobile sinks and key pre-distribution. Organizations operating in the oil and gas sector face enormous challenges in the field of security, so while working with Wireless sensor networks, authentication & secure communication is vital. Mobile Sinks are essential for wireless sensor network application because of the data loss due to failure of a single sink node or base station. For securing mobile sinks, a frame work with key pre-distributions are a good choice, and it consists set of key pools ,for mobile sink nodes to access the sensor network and for secure communication among the sensor nodes, mobile sink and base station. Symmetric and asymmetric encryptions are used for higher security. After monitoring the disasters, mobile sink informs base station and take necessary actions to overcome the situation.

## 1. INTRODUCTION

Wireless sensor Network consists of autonomous sensors which are spatially distributed, that also monitors physical or environmental conditions and pass their data cooperatively

through a network to a main location. The commonly monitored parameters are temperature, humidity, pressure, wind direction, speed, illumination intensity, vibration intensity, pollutant levels, vital body functions etc. Sensor networks can be deployed for habitat monitoring, environmental monitoring including forest fire detection, air pollution and green house monitoring, industrial and consumer applications. They are extremely useful in military applications that demand high security for nuclear and chemical attack detection, battlefield surveillance and so on. Sensor networks can be deployed for habitat monitoring, environmental monitoring including forest fire detection, air pollution and green house monitoring, industrial and consumer applications. They are extremely useful in military applications that demand high security for nuclear and chemical attack detection, battlefield surveillance and so on.

Using wireless sensor networks data's are transmitted in broadcast manner so security of data is very important during transmission. Wireless Sensor Networks are easily vulnerable to various security attacks. Security is critical for these networks deployed in hostile environments. Most sensor networks monitor their surroundings actively, and to tamper the network to get the data and deduce information other than the data monitored is very easy. The wireless communication employed by sensor networks facilitates eavesdropping and packet injection by an adversary. The combination of these factors demands for sensor networks at design time to ensure operation safety, secrecy of sensitive data, and privacy for people in sensor environments.



**Figure 1: Wireless sensor network with mobile sink**

The location of the personals working in the rig is uncertain. While occurring any disastrous events, it is very difficult for the Control station officers to locate the positions of the workers in the particular sites. It requires more time and effort. Portable device can be used to overcome these problems. These devices can be fixed in their helmet or jacket. The devices have also the facilities for measuring various parameters because they consist of sensors. They are Gas sensor, Temperature sensor, Heart beat sensor, Pressure sensor. These portables device sense various parameters (gas, temperature, pressure) continuously. And if the sensed value exceeds a reference value, it immediately activates the relay driver and produces an alarming sound. So it will be useful for the person to know about hazardous situation. Heart beat sensor, senses the



workers heart beat continuously. If the person loses his/her consciousness then this information is sensed by the sensor and it will be passed to the control room.

When base station is too far from the sensing field, transmitting the data over long distances using Multihop may further weaken the security. It requires more energy at nodes near the base station while forwarding data to base station, and thus reducing the lifetime of the network. Therefore, the better option in the operation of sensor network application is mobile sinks (MSs), including data collection in hazardous environments, localized reprogramming, oceanographic data collection, and military applications etc.

## 2. RELATED WORKS

Wired and wireless networks can be implemented using variety of security algorithms but they cannot be used in wireless sensor networks because of the limited energy, memory and computation capability. The basis of the secure communications and the fundamental security mechanism in wireless sensor network is Key management protocols. WSN mainly faces the problem of mobile sink replication attack. To overcome this problem, an existing mechanism is three tier security frameworks for authentication and pair wise key establishment, based on polynomial pool based key pre-distribution scheme. This technique is able to give network resilience to mobile sink replication attacks. Two separate polynomial pools are used, a mobile polynomial pool and a static polynomial pool. Polynomials from Mobile polynomial pools are used for authentication between mobile sinks & stationary access nodes. Polynomials from static mobile pools are used for authentication and key establishment between sensor nodes & Stationary Access nodes. Before deployment random subset of polynomial from mobile polynomial pool is selected for mobile sinks and stationary access nodes are given a polynomial from mobile polynomial pool. Similarly, random subset of polynomial from static polynomial pool are selected for all the sensor nodes & stationary access nodes. To launch a mobile replication attack, attacker has to get at least a single polynomial from mobile polynomial pool to gain access to the network. To launch a stationary access node replication attack, attacker has to get at least a single polynomial from static polynomial pool to gain access to the network. The limitation of this scheme is it may introduce considerable communication overhead.

## 3 Problem Definitions And Algorithm

In wireless Sensor network Security & Privacy support is major concern The sensor nodes are normally deployed in harsh, & unattended remote areas, so wireless sensor networks are susceptible to various security attacks due to lack of tamper resistance, sensor node failures, limited processing capabilities and non-availability of human assistance. Secure ways for communicating data are not available for wireless communication. The user can enter to the network and collect data based on his interest by compromising sensor nodes, so the sensors must send the sensed data to the intermediary only by encrypting with symmetric encryption. The Symmetric encryption is preferred because the sensors have no or little intervention with users. Various authentication and key predistribution based

on symmetric schemes exists for sensor networks. To address the security issues, a general framework that permits the use of any pair wise key pre distribution scheme to make pair between sensor nodes and Mobile Sinks based on the RSA symmetric encryption algorithm is used. The proposed technique will substantially improve network resilience to mobile sink replication attacks compared to the single polynomial pool-based key pre distribution approach. Shortest path is selected during the process of making pair between the nodes for data transmission. Here this work consists of a smart phone as sensor, the minimum requirement for using a smart phone as sensor is it must have sensors to sense temperature, heat, pressure etc. For the connectivity between the sensor and the wireless network, IEEE 802.11ac is used because it is the common standard for wireless connectivity of the smart phones.

### 3.1 Algorithm

Preliminary communication between the sensor and mobile sinks for authentication requires heavy computation may degrade the performance of the system. The keys are pre-distributed between the sensors and mobile sinks [6]. To sign the message 'M' from sensor to mobile sink first compute the hash function  $h = \text{hash}(M)$ , here  $h$  is implemented via cryptographic hash function MD5. The key generation algorithm runs RSA to obtain the values of  $N$ ,  $d$  and  $e$ . The key generation algorithm returns  $pk$  and  $sk$ , where  $pk = (N, e)$  and  $sk = (N, d)$ . Signature generation is as follows

Sign  $N, d (M)$

a)  $Y \rightarrow H(M)$

return  $y^d \bmod N$  Verification process is as follows

Verify  $N, e (M, x) Y \rightarrow x^e \bmod$

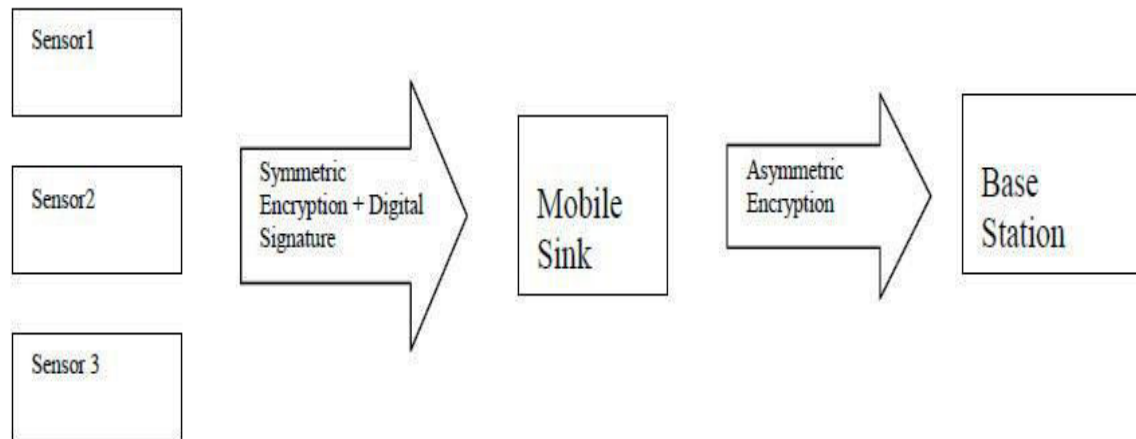
$Y^1 \rightarrow H(M)$

If  $(y = y^1)$  then return 1 else return 0, here  $(M, x)$  is the message signature pair.

The RSA algorithm is used for communication between the sensor and the mobile sink because it is one of the first practical public-key cryptosystems and is widely used for secure data transmission. Sensors have only minimum storage capacity and least human interventions so for authentication between the sensors and mobile sinks private key encryptions are more suitable. The main reason for choosing this algorithm is that the data required to be encrypted and decrypted will be of small size, so that it doesn't degrade the performance speed and its overall performance is better than other asymmetric algorithms. RSA requires least amount of storage space for encrypted files [7].

b) Authentication efficiency for communication between mobile sink and base station is critical. To provide secure communication asymmetric key encryptions are used. This work mainly consist of two encryption mechanism such as AES encryption mechanism and one time password creation using hash function for communication between the base station

and mobile sink[8]. Figure shows the encryption mechanisms used during communication.



**Figure 2: Encryption mechanisms for communication**

#### **4. IMPLEMENTATION AND PERFORMANCE EVALUATION**

This work consists of three modules.

##### **4.1. Sensors**

The sensor detects temperature, pressure, and light value continuously and sends data in an encrypted form while it crosses the threshold value to the mobile sinks. While detecting any events, the sensors immediately activates an alarm to alert workers and send notifications to coast guard systems. Base station must validate and authenticate each sensor before deployment. Sensor generates keys for communication and sends the sensed data along with the key to the mobile sink. Transmission is in broadcast manner. As smart phones are used as sensors, each worker may have smart phones and they can use their phone as sensors, which may also have connectivity with mobile sinks. An android application is created for setting the threshold value and locating the sensors. All the sensors are positioned in the rig. There are many smart phones accessible which will work as sensors even they are in flight mode. Satellite phones are other alternatives which can also be used as sensors. To track the location of sensors, GPS services are included with sensor module.

##### **4.2 Mobile Sinks**

Coast guard Systems consists of dedicated systems with wireless connectivity which rotates around the rig in a boat on a committed path, acts as mobile sink which provides the communication link between sensor and control room. The coast guard systems must be authorized and approved by the control room authorities. Coast guard receives the encrypted data from the sensor and decrypts the message using the symmetric algorithm. It

can check the notifications from the sensors and inform the emergency notifications to the control room, by encrypting the data using asymmetric algorithm. For secure data transfer between the sensor and control room using wireless network communication, the mobile sink (coast guard) must use the symmetric and asymmetric algorithms. Mobile sink also have the GPS service to locate the sensor.

#### **4.3 Base Stations**

Control room system which monitors each and every operations as well as the status of off- shore and on-shore plant acts as the base station. It records all the details about the sensors and coast guard systems. It receives notification on any disaster detection and decrypts the encrypted message from the coast guard using asymmetric algorithm. They are responsible for taking necessary actions on notification from coast guards such as informing the rescue team and acknowledging the coast guard and the persons on the rig etc.

The proposed work consists of the following steps

- i.) Sensor compute private key and sends its data with its own ID to the Mobile sink.
- ii.) Mobile sink decrypt the message and send the message to base station using asymmetric algorithm.
- iii.) Base station decrypts the message, take necessary action for disaster recovery and also acknowledge the mobile sink.

Compared to other schemes, the proposed system is efficient and the system has the following advantages:

- it provides better performance and authenticity
- no leakage of data and secure data transmission
- Free from wireless attacks
- An intermediate is present between the two sensor nodes for providing data security
- There is no complexity in computation and memory usage
- Few number of computational steps that are automatic, so no need of manual computation

#### **5. EXPERIMENTAL RESULT**

This work results a secure communication between the sensor node, coast guard system and the control room. As the RSA encryption mechanism is used, it is more secure for communication between the coast guard system and the control room which require high protection. Symmetric encryption is used between the sensor node and the coast guard, so attacking becomes difficult with compromised nodes. The time occupied for data transmission and connection establishment is less compared to the existing system. This work detects disasters and makes alarm to notify the employees about the disasters and communicate with coast guard system. Coastguard system report control room about the emergency situation and control room taken necessary actions for rescue operation. As compared to existing system it has better performance.



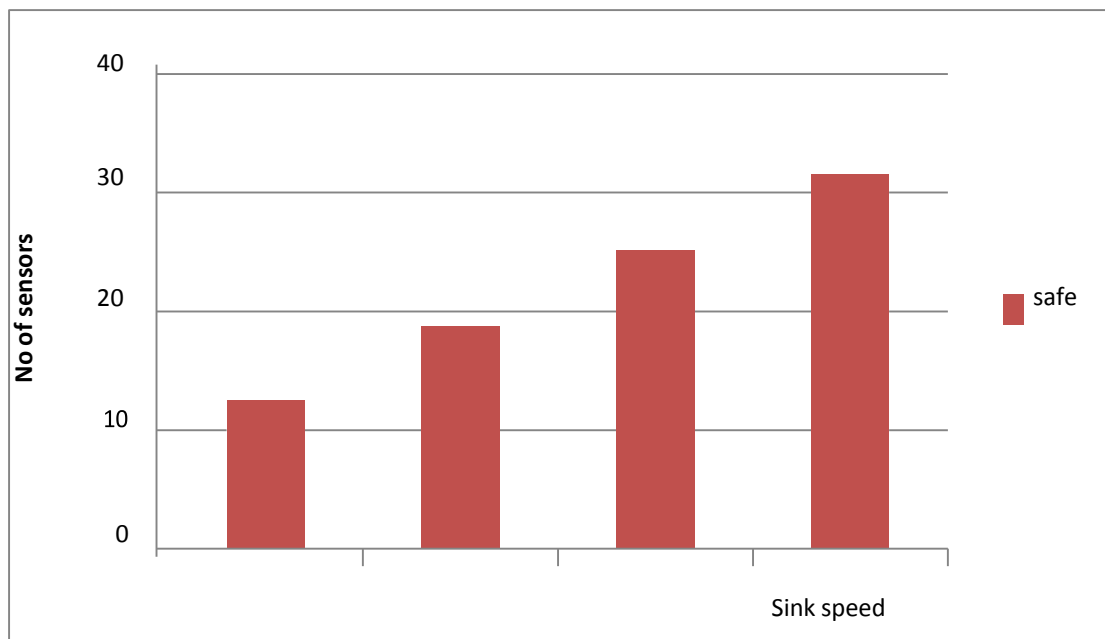


Figure 3: Performance evaluation based on number of nodes and sink speed

## 5. CONCLUSION

Delivering the right information at the right time is very crucial in disaster management. In wireless sensor networks security and privacy support with minimum cost is a major concern. The smart phones and web technologies in disaster management should be seen as a new era in micro blogging during disasters to aid in identification of victims and survivor. It does not compromise the leakage of data.

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# Privacy Preserved Online Garment Designing Using Cryptography, Visual Steganography & Image Slicing

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## Abstract

*In recent time E-Commerce market is rapidly grown in the world .Online shopping has become more popular. Credit or Debit card fraud and information security are major problems for customers, vendors and banks. This work presents a new approach for providing security for personal information during online shopping thereby securing the customer data and high customer confidence and preventing identity stealing. The method uses two types of Cryptography, visual steganography and image slicing. Web based Garment Designing Tool helps the user to design their own clothes and accessories online, it facilitate easy access of online shopping. To design clothes or start a fashion label, designing clothes take thoughts and assurance. It have to be able to envision the outfits design, to draw them, and then to decide the fabric and embroider the clothes that have been dreaming of. So buy product through this site.*

## 1. INTRODUCTION

Online shopping will be revolutionizing the business to making everything to anyone could want available by the simple click of a mouse button [1]. Identity theft[2] and phishing[3] are the common dangers of online shopping. Attackers can pinch and abuse data, leading to

painful disclosure, poor publicity, and fines. In this work, a new method is proposed, that uses two types of Cryptography, visual steganography and image slicing, which reduces information sharing between client and online vendor but enable successful fund transfer from client's account to vendor's account thereby securing client personal information and preventing misuse of information at vendor side. The method proposed for E-Commerce but can easily be extended for online banking as well as physical banking.

Web based Garment Designing Tool helps user to design their own garments through online .It facilitates easy access of online shopping. To design clothes or start a fashion label, designing clothes takes imagination and commitment. To envision the outfits to design, to draw them, and then to choose the garment .This proposed system aims that user can design their own clothes such as T-shirts, shirts ,Churidar, Sarees and accessories such as cup, bag, cap, and clothes such as T-Shirts, churidars, etc. are stylish, comfortable and liked by all segments of people. It offers customized tee with an option to upload image, text. Instead of asking designers to sketch out free-form designs, this provides a web-based scrapbooking tool that access a large library of fashion pieces. It encourages users to create sets, track other users and inspire each other with fashion find. The site also inspire imagination by hosting design. In the proposed work user can buy so it introduces a new advance for providing restricted information only that is essential for fund transfer throughout online shopping so, safeguarding customer's data and increasing self-assurance and preventing identity theft technique uses combined function of cryptography and visual steganography for this purpose, and also uses image slicing for more secure.

## **2. CRYPTOGRAPHY,STEGANOGRAPHY AND IMAGE SLICING**

Cryptography [4] is the study of mathematical technique associated to information security such as data integrity, confidentiality, entity verification, and data origin verification. Cryptography helps to protect information by transforming it into an unreadable format. The plaintext or original text, is converted into a coded equivalent called cipher text by an encryption algorithm. Only those have a secret key can decipher (decrypt) the cipher text into plaintext. Cryptography systems can be generally classify into symmetric-key systems and asymmetric-key systems.

Steganography [5] derived from the Greek steganos (covered or secret) and -graph (writing or drawing). Steganography can be defined as the beating of data by embedding messages contained by other messages, images, graphics or sounds.

Image slicing [6] and concatenating, and other image handling techniques are important in parallel computing. It receiving small chunks of an image which can be manipulated parallel. In such a scenario it can be concatenate those chunks together. To split an image imageio package are used.

## **3. RELATED WORK**

The conventional method of online shopping involve customers or client selecting items online shopping portal and direct it to the expense access. Different expense access have different methods of storing detailed data of consumer. The important use of graphic images

might be a trouble to customers with slow internet connection. Initially, the decision was to build a 3D design tool; consider the bandwidth issue, a 2-D design tool was developed instead. The main confront is to present sensible images at satisfactory transfer rate. Creating garments parts and integrating with the system make sure, a match and perfect fit cause another difficult task.

In result to hide 4 letter word, 8 words are required not including the words that are added to provide flexibility in sentence building. So to hide a large message, this technique requires large no of words and create a difficulty in sentence construction. By Applying it to online banking to create spam mail to hide one's banking information ,it use existing pattern blocks to create new styles of garments. It cannot rely on the Payment Procedure.

#### 4. METHODOLOGY

##### 4.1 Methodology of Crypto Analysisto Hide Text

Customer will enter the data to use online payment. Firstly, use blowfish algorithm then stores it in a string and secondly RSA algorithms are used to encrypt data more securely.

##### 4.1.1 Blow Fish Algorithm

It is a symmetric block encryption algorithm designed in consideration with, Fast, Compact, Simple, Secure. It encrypts block data of 64-bits at a time. it will follows the feistily system and this algorithm is classified into two parts: Key-expansion & Data Encryption. Key-expansion: It will translate a key of at most 448 bits into more than a few sub key arrays totalling 4168 bytes. Blowfish use large number of sub keys. These keys are generating before to any data encryption or decryption. Data Encryption having a purpose to iterate 16 times of system. Every round consists of key-dependent variation and a key and data-dependent replacement. All operation is XORs and add-ons 32-bit words. The additional operations are four indexed array data find tables for every round.

##### Algorithm: Blowfish Encryption

Divide x into two 32-bit halves: xL, xR

For i = 1 to 16:

$xL = XL \text{ XOR } P_i$

$xR = F(XL) \text{ XOR } xR$

Swap XL and xR

Swap XL and xR (Undo the last swap.)

$xR = xR \text{ XOR } P_i$

$xL = xL \text{ XOR } P_i$

Recombine xL and xR

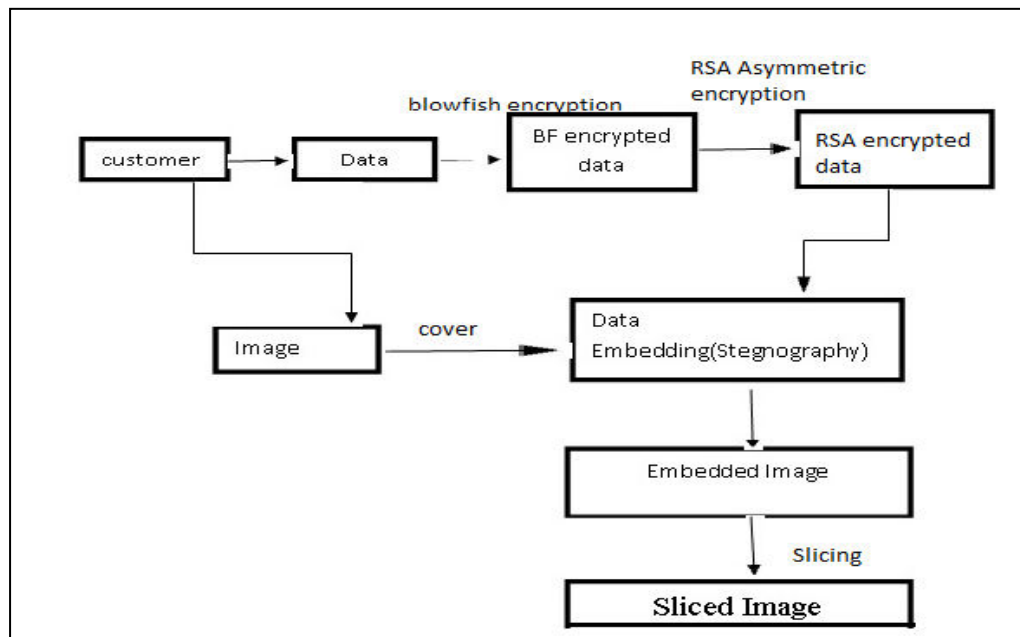
##### 4.1.2 RSA Algorithm

The public key contains modulus n and the encryption exponent e. The private key contains the modulus n and the decryption exponent d, which must be kept top secret. p, q, and  $\phi(n)$  must also be kept secret since they can be used to calculate d. An another, used by PKCS#1, is to desire d matching  $de \equiv 1 \pmod{\lambda}$  with  $\lambda = \text{lcm}(p-1, q-1)$ , where lcm is the least common multiple. By  $\lambda$  instead of  $\phi(n)$  allow more choice for d.  $\lambda$  can also be define using



the Carmichael function,  $\lambda(n)$ . Since any regular factors of  $(p-1)$  and  $(q-1)$  are present in the factorization of  $p*q-1$ , it is recommended that  $(p-1)$  and  $(q-1)$  have only very small common factors, if as well the necessary 2. Equations and formulae must be typed in Mathtype, and number consecutively with Arabic numerals in parentheses on the right hand side of the page. They must also be separated from the adjacent text by one space.

#### 4.2 Data Embedded (Steganography)



**Figure 1. Data embedding**

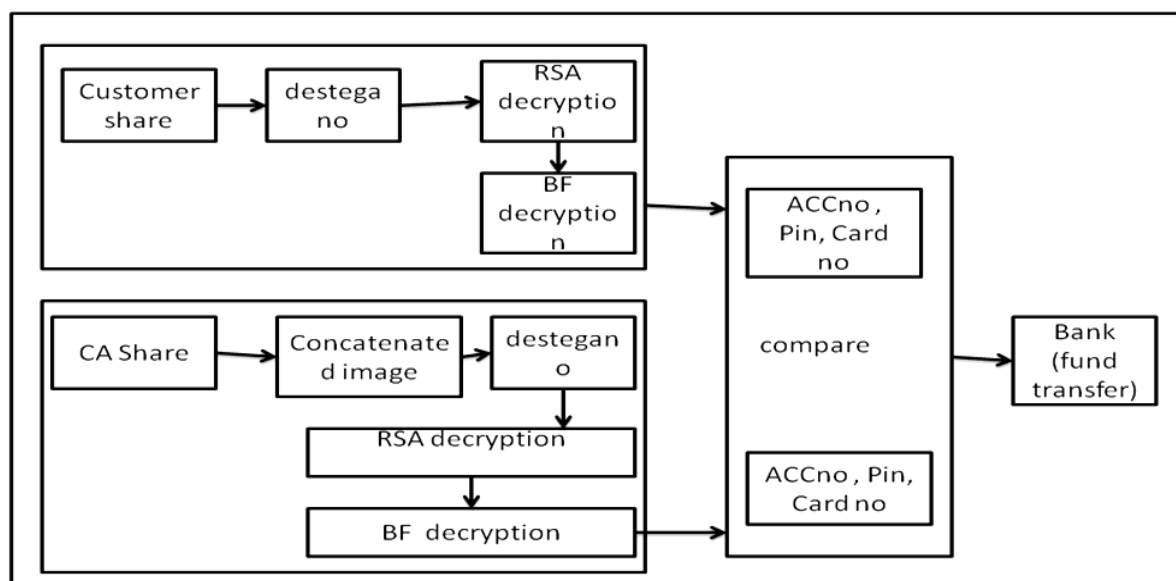
In figure1 the Cryptography data's are embedded or hide in a cover image. It may become, more secure. Then the images are sliced [7].

#### 4.3 Image Slicing

Image slicing and concatenating and other image manipulation techniques are important in parallel computing. This work uses a pretty straight forward way to split an image using Java imageio package. Firstly read the image file into a class File Input Stream, it contains input bytes from a file in a file system and it is meant for reading streams of raw bytes such as image data. Then object of File Input Stream put on class Buffered Image. A Buffered Image is a kind of class for doing with Images, so you can do anything with a Buffered Image that you can do with an Image. For instance, the Graphics class contains a number of methods for drawing Image objects. Some of these methods take only an X and a Y coordinate at which to draw the image and just draw the image at its original size. It also takes a width and a height and scale the image as appropriate. Then create a Buffered Image array with size of number of images want to slice. Initialize the image array with readied image's height width and type by the help of Buffered Image. Create 2dgraphics in each array elements by Graphics2D, this graphic field are have rectangle of pixels stored in memory. Draw images in this field by draw Image () method of class Buffered Image, draw Image() method in Graphics2D actually operates on a Buffered Image object. This

technique process the specified Buffered Image as specified by a Buffered Image Op object and then draws the processed image at the specified position. Image processing with Buffered Image Op objects in more detail shortly. The draw Image() method operate on a Buffered Image object instead of an Image object. Finally writing mini images from array into new image files making use of the Image IO utility class of Java. Finally number of sliced images created as per the number of elements in the array.

#### 4.4 Image Retrieval and Data decrypting



**Figure 2:Image retrieval and data decrypting**

The purchasing time user will upload the secured image and enter the secret message then CA will decrypt it first. CA have stored the sliced image. CA will concatenate the sliced image and apply destegano process then the decrypted details will got. Then apply the RSA Decryption Algorithm for decrypting the details then got the string again[8].

## 5 RESULTS

In this proposed work, data submitted by the client to the online vendor is minimized by providing only minimum information that will only check the payment done by the customer from its bank account. This is achieved by the beginning of a central Certified Authority (CA) and joint application of steganography and visual cryptography. Here the banking registration details is kept in the encrypted format and then embedded in the image that selected by user at registration process. When user doing registration the details of account no, userpin, cardno...etc is first encrypted by blowfish encryption method and then that encrypted data are again encrypted by asymmetric encryption method like RSA. This encrypted data is used as input to doing steganography. The output after RSA encryption is embedded in to an image that selected by user at registration. This embedded image is sliced into different equal parts and stored at well. The information received by the vendor can be

in the type of account number connected to the card used for shopping. The data will only legalize receipt of payment from authentic customer.

**BANKING REGISTRATION FORM**

User id:

Account No:

Secret Pin:

Card no:

[Apply Encryption](#)

**Fig.3.1: Registration**

**Encryption information**

user\_id:

Your Account No:

Your Pin\_no:

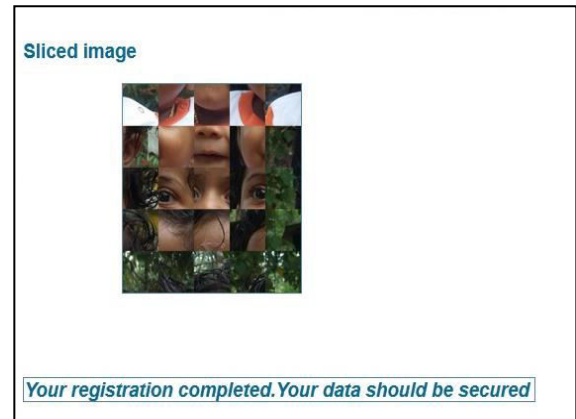
Card no:

[Upload Image](#)

**Fig.3.2: Encrypted data**



**Fig.3.3: Upload image**



**Fig.3.4: Sliced image**

## 6. CONCLUSION

In this work, a payment system and web based Garment Designing Tool for online garment design is proposed by combining text based cryptography and visual steganography and image slicing, that provides customer data privacy and prevents misuse of data at vendor's side. The method is concerned only with obstacle of identify stealing and customer data security. In comparison to other payment this work which uses steganography, visual cryptography & image slicing, are basically applied for physical banking, the proposed method can be applied in the area on payment during online shopping as well as physical banking. Web based Garment Designing Tool helps the user to design their own clothes and accessories online, it facilitate easy access of online shopping.

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# Jamming Attacks Prevention Using Data Hiding Methods

<b>Paper ID</b>	<b>IJIFR/V3/ E12/ 038</b>	<b>Page No.</b>	<b>4620-4625</b>	<b>Research Area</b>	<b>Computer Network</b>
<b>Keywords</b>	<b>SHCS, RSA, AONT-HS, Selective Jamming Attacks, Protocol Semantics, Decoding Packets</b>				

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## Abstract

*Jamming or interference in network environment has been addressed under an external threat model. In external threat model jammer is not part of the network. This work addresses the problem of jamming under an internal threat model. An adversary who is aware of network secrets and the implementation details of network protocols at any layer in the network stack. The adversary exploits the internal knowledge for launching selective jamming attacks in which particular messages of “high significance” are targeted. Jammer can target route-request/route-reply messages at the routing layer and thereby severely degrade the throughput. This strategy is actualized either by classifying transmitted packets using protocol semantics or by decoding packets. After classification, the adversary induces a sufficient number of bit errors so that the data cannot be recovered at the receiver. Packet hiding methods are proposed to ensure secure data transfer. The method includes Strong Hiding Commitment Scheme (SHCS), asymmetric encryption using RSA algorithm, An All or Nothing Transformation Hiding Scheme (AONT-HS).*

## 1. INTRODUCTION

In network communications there are more chances of attacks. There are wired and wireless networks. There is no guarantee regarding data transfer over network. Open nature of wireless medium leaves it vulnerable to intentional attacks [7]. One simple solution is to apply high transmission power on jammed channels representing jamming to be fewer of a threat. Another countermeasure of jamming is to use directional antennas instead of omnidirectional antennas. The basic open issues in this field includes: 1) energy efficient detection of jamming 2) jammer classification in detection scheme, and 3) jamming and anti-jamming in networks. Adversaries with internal knowledge of protocol terms and network secrets can launch attacks. Attacks adversely affect network performance. Jamming is a type of attack and are much harder to counter. In jamming, the adversary interferes by transmitting continuous unwanted signals. Jamming causes Denial-of-service (DOS), inject spurious messages [2]. Jamming can be internal or external attack. Jammer is not part of the network in external threat model. In the problem of jamming under an internal threat model, adversary is aware of network secrets and the implementation details of network protocols. In an organization, a number of employees work under a common manager. The credential details used for the contact between employees and manager will be well understood for each employee. Any staff can act as an internal threat source by exploiting the details. Jamming strategies include the continuous or random transmission of high-power interference signals. But the continuous presence of high interference levels makes these type of attacks easy to detect. Under an internal threat model, real-time packet classification is feasible for launching jamming attacks. Jammer can classify transmitted packets in real time by decoding the first few cipher of an on-going transmission. Jammer can significantly impact performance with very low effort. In wireless networks four types of jammers are considered: Constant jammer, Reactive jammer, Deceptive jammer and Random jammer. These types of attacks can be prevented by implementing packet hiding methods. For developing a secure data transfer over the network, three methods are proposed in this work. Primarily, SHCS is a steganography method in which data can be kept hidden within an image. Secondary an asymmetric encryption occurs. Asymmetric encryption occurs on the output of SHCS method. Finally, AONT-HS is applied to make the data more secure

## 2. PRIOR WORK

Conventional anti-jamming techniques rely extensively on Spread-Spectrum (SS) communications or some form of jamming avoidance [2]. SS techniques provide bit-level protection by spreading bits according to a secret Pseudo-Noise (PN) code, known only to the communicating parties. These methods can only protect wireless transmissions under the external threat model. Channel hopping methods are also used to avoid jamming attacks in wireless networks[5]. In proactive channel hopping, after a certain interval of time the currently used channel switches to another. These switching occurs irrespective of whether jamming occurs or not. Reactive channel hopping assumes a fixed threshold value. If the

waiting time for accessing a channel exceeds that fixed value, jamming is assumed. One among the unused channel is selected in straight forward channel hopping.

Elementary jamming consists of proactive as well as reactive jammers [6]. In proactive jamming, when jamming is detected, nodes in the network can map the jammed area and re-route traffic. Jammed area mapping protocol maps jammed area in network and also migrates the data in affected area. Reactive jamming conducted at the sender end can be detected by checking received signal strength, signal-to-noise ratio, and packet delivery ratio. Variety of wireless networks exists, ranging from ad hoc networks to wireless LANs and sensor networks. The shared nature of the wireless medium allows adversaries to create non-cryptographic security threats by conducting radio interference attacks. Consequently understanding the nature of jamming attacks is critical to assuring the operation of wireless networks.

### 2.1 Disadvantages

- Broadcast communications are particularly vulnerable under an internal threat model.
- Existing methods only protect wireless transmissions under the external threat model.
- All intended receivers must be aware of the secrets used to protect transmissions.
- Compromise of a single receiver is sufficient to reveal relevant cryptographic information.

### 3. PROPOSED SYSTEM

Problem of real-time packet classification is removed by a packet-hiding scheme based on commitments. Has been investigated the feasibility of real-time packet arrangement for initiation selective jamming attacks, under an internal threat model.

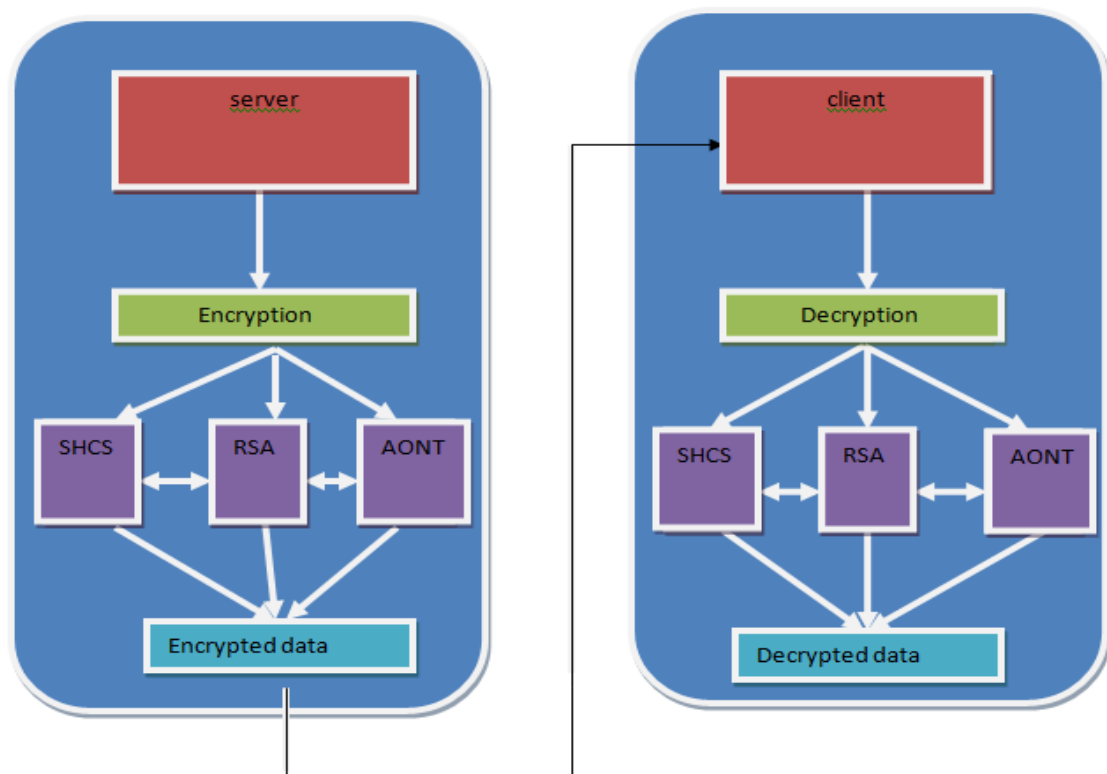
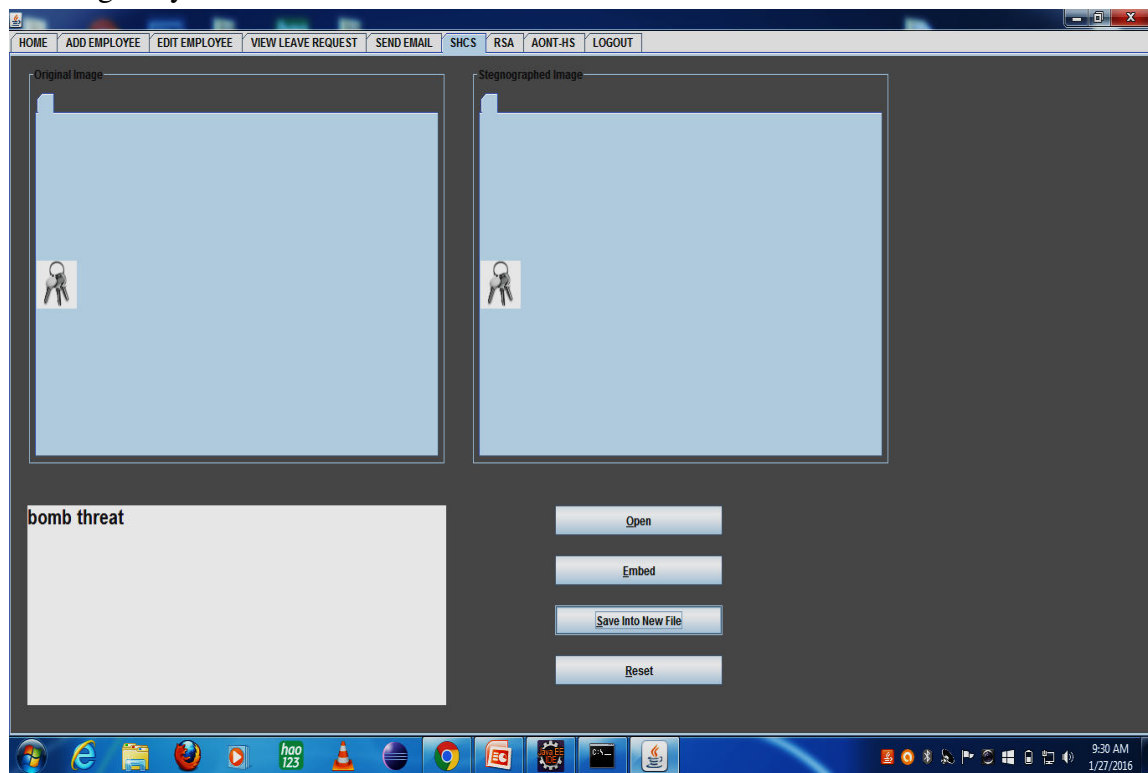


Figure 1: System Architecture

Such attacks are relatively easy to actualize by exploiting knowledge of network protocols and cryptographic primitives extracted from compromised nodes. Packet hiding is a three step process. The confidentiality of the message will be conserved by using all the three methods. From Fig 1 the working of proposed system is clear .If server needs to launch data to a client, the data passes through all the three schemes. Encrypted data is send to the client. Decryption takes place at the client side.

### 3.1 Strong Hiding Commitment Scheme

SHCS is a cryptographic method for data hiding [3]. A symmetric encryption technique with static key shared between sender and receiver. At the sender side (server) the key is used to hide the data within an image whereas the receiver (client) will use the same key for decryption. Strong hiding property keeps the computation and communication overhead to a minimum. To satisfy the strong hiding property, the packet carrying data is formatted so that all bits of data are modulated in the last few PHY layer symbols of the packet. To recover data, any receiver must receive and decode the last symbols of the transmitted packet, thus preventing early disclosure of data.



**Figure 2: Strong hiding commitment scheme**

### 3.2 Asymmetric encryption

For strong encryption, RSA is used. In such a cryptosystem, the encryption key is public and differs from the decryption key which is kept secret. In RSA, asymmetry is based on the practical complexity of factoring the product of two large prime numbers .Symmetric encryption means taking plaintext and converting it to ciphertext, using the same secret key



for both encryption and decryption. Main disadvantage of symmetric encryption is that all parties involved in the communication have to exchange the key used to encrypt. Using the same key decryption occurs. Asymmetric algorithm uses two independent keys. One to encrypt the data and the other to decrypt it. RSA (Rivest, Shamir and Adleman) asymmetric method is used here.

### **3.3 An AONT-based Hiding Scheme (AONT-HS)**

Packets are pre-processed by an AONT before transmission but remain unencrypted. The jammer cannot perform packet arrangement until all pseudo-messages corresponding to the original packet have been received and the inverse transformation has been applied.

### **3.4 Advantages**

- Data security that saves money on extra protection software.
- Preserves confidentiality and user friendly.
- Encryption provides confidence that your backups are safe
- Encryption is the most reliable way to secure data..
- Preventing selective jamming by the method of encryption with static and dynamic keys.
- Can transform a selective jammer to a random one.
- Prevent real-time packet classification by combining cryptographic primitives

### **3.5 Experimental Result**

Data security that saves money on extra protection software. Encryption provides confidence that your backups are safe can transform a selective jammer to a random one.

## **4. CONCLUSIONN**

The jammer can classify transmitted packets in real time by decoding the first few symbols of an on-going transmission. A selective jammer can significantly impact performance with very low effort. Problem of selective jamming attack has been resolved by providing strong hiding and encryption of data. Proposed three schemes can transform a selective jammer to a random one by preventing real-time packet classification. In an internal adversary model, jammer is part of the network under attack. Being aware of the protocol specifications and shared network secrets, jammer cannot be able to compromise all the data if the proposed methods are applied.

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# Design And Development Of Hydrodynamic Vortex (Up-Flow) Pretank Rainwater Filter

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<b>Keywords</b>	Hydrodynamic Vortex Separators (HDVSSs), Robust Pretank Filter, Water Quality Output, Turbidity, Electrical Conductivity, Pre/Post-Filtration Physico Chemical Parameters, Control Factor, Orthogonal Array, Filter Composite Filtering Capacity				

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## Abstract

Rainwater harvesting is a technique of collection and storage of rainwater into natural reservoirs or tanks, or the infiltration of surface water into subsurface aquifers (before it is lost as surface runoff). Rainwater captured from rooftops and paved roads contain significant quantities of plant debris, soil, eroded roof materials, and other solids that can clog pumps, valves, and pipes. Mineral solids collect as sediment at the bottom of storage tanks, reducing tank storage capacity. Organic solids remain in suspension and decompose, depleting oxygen and generating hydrogen sulphide and other noxious by-products. It is essential to filter all of the rainwater with low-maintenance, high-rate, mechanical filters specifically developed for rainwater harvesting. Because rainwater harvesting needs are so varied, a robust Pretank filter is needed that can purposefully cater the needs of all kinds of domains it is fitted into, such as industries, residence or roadways. This paper is focused on design and development of Pretank Rainwater Filter based on the concept of Robust Product Design to effectively filter sludge and undesired physical contaminants along with comprehensive separation of oil/grease elements, subsequently analyzing the post filtered water for domestic and industrial usage.

## 1. INTRODUCTION

Millions of people worldwide suffer from lack of water. The problems facing water sources have been well documented. There are many factors that compromise quantity and quality of water supply sources in some developing countries. Fresh water scarcity has become a serious global threat due to rapid hazardous population growth, frequent droughts and changing climate pattern. Going green has become increasingly popular recently. Small steps can make a huge impact. It is found that rainwater harvesting, the collection of rain from surfaces upon which it falls, is a long-standing practice of many countries still used as a means for dealing with the water problems of today. Harvesting rain is a practice that has been around for centuries. Cisterns and other rain harvesting systems are widely used in Europe, Australia, the Bahamas and countless remote countries - many who depend solely on rain for day to day life. Rainwater harvesting systems provide distributed storm water runoff containment while simultaneously storing water which can be used for irrigation, domestic purpose (it can be purified for use as everyday drinking water), or can be used in production operations in industries.

Having a quality water tank is only the first step of ensuring the on-going quality of the rainwater harvested for usage. To ensure the best possible quality of water it has to be ensured that any debris or dirt is removed from the rainwater harvested before it is stored in a rainwater tank. To achieve that, rainwater should be both filtered and aerated. Filtration removes large particulate matter, which frequently both carries and feeds bacteria. Removal of this particulate matter, along with oxygenation of the water, greatly reduces the amount of harmful bacteria in the tank. One way to improve the quality of rainwater is to install a “roof washer” or “first-flush diverter”, a device that discards the initial runoff from a roof before it reaches the storage tank. While this technique has some value in regions with extended dry seasons and short but intense rain storms, it is not very effective in regions where rainfall is distributed throughout the year or where rain is often an all-day event. Regardless of whether a first-flush diverter is installed, it is essential to incorporate mechanical filters typically designed for rainwater harvesting.

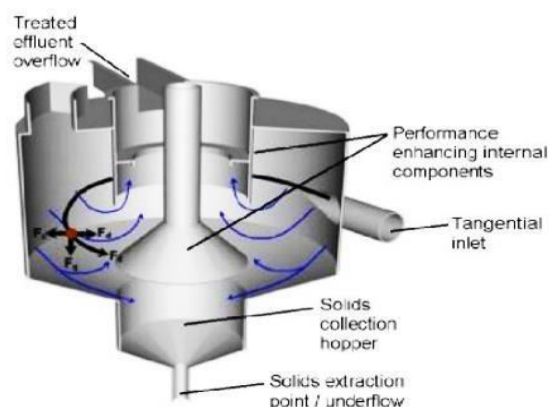
Among the other different types of storm water/rainwater Pretank filters, a hydrodynamic filter is the preferred choice for most of the rainwater harvesting systems, because it can be retrofitted into the existing storm drainage system and requires a relatively small footprint and construction cost. Generally called Hydrodynamic Vortex Separators (HDVSSs), they are compact, low energy solid-liquid separation systems that utilize the dynamic energy in a flowing effluent to perform their function. Operating hydraulically, they have been used for applications ranging from removal of coarse solids from an effluent (e.g. removal of grit from sewage), through to primary sedimentation (e.g. of municipal and industrial effluents). HDVSSs have also been used in conjunction with settlement aids such as coagulants and flocculants, and also chemical disinfectants, allowing further enhancements in treatment performance to be achieved. With driving head requirements of typically less than 150mm, these separators operate effectively within the context of a gravity-fed treatment facility, where they have no external power requirements. Combined with the fact that they have no



moving parts, and therefore minimal maintenance requirements, operating costs tend to be low.

In design and development problems, a product design is called robust if it produces results that are stable enough with respect to perturbation of model input parameters. Robust design ensures product performances and therefore results in high quality and productivity. Product Robustness assessment, which evaluates the variability of performances, is an important and indispensable component of robust design. An accurate and efficient robustness assessment is essential for obtaining a real robust solution. In engineering design and its optimization, the designer may prefer a use of robust product solution to a more optimal one to set a stable system design. Although in literature there are a handful of methods for obtaining such solutions, they do not provide a designer with a direct and systematic control over a required robustness. In this project of developing robust filtration equipment a concept of multi-objective performance engineering is used, which was able to generate robust design parameters for model uncertainties.

## 2. THE PRINCIPLES OF HYDRODYNAMIC SEPARATION



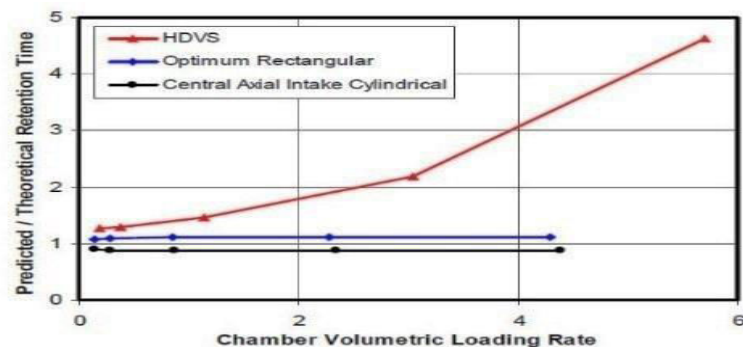
**Figure 1: Schematic Representation of Hydrodynamic Vortex Separator (HDVS)**

A HDVS comprises of a cylindrical chamber with a tangential inlet, an overflow channel or pipe, a solids collection hopper with extraction facility, and an array of specially designed internal components. In operation, the objective is to separate and concentrate solid material from the entering flow into a small proportion of the total, and to remove this through the underflow. The treated flow, typically accounting for in excess of 90% of the inflow, is then allowed to pass to the overflow, either for storage into an underground tank, or for further treatment, depending on the application.

Idealized sedimentation theory would suggest that a particle entering a settlement chamber will become separated if its settling velocity is greater than the velocity of fluid rising to the overflow. However, in real systems, operation is far more complex. When flow enters a HDVS, it causes the contained flow to rotate about the chamber axis. The result of this is that the flow follows a very long, spiral flow path through the system, initially spiraling down the outer wall towards the base, then reversing direction and spiraling upwards, closer to the centre, towards the overflow.

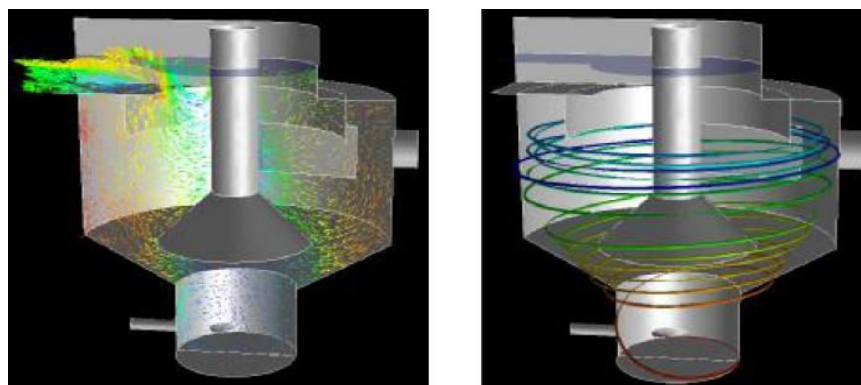
Entrained particles will be subjected to a number of forces, including those due to gravity, fluid drag and centrifugal acceleration. It is the balance of these forces that will determine particle trajectories, and hence whether or not they are separated. While spiraling and settling under the force of gravity, entrained particles will tend to migrate to a radial location at which radial drag towards the centre and outwardly acting centrifugal forces are equal. Heavy particles will tend to migrate to an outer radial position, enabling them to continue to settle towards the base, while light particles will tend to migrate towards the centre, where they will be subjected to the drag of flow rising towards the overflow. Once on the base, settled particles will be swept towards the central collection hopper by secondary flow currents, a phenomenon that can be replicated by stirring a cylindrical vessel containing water and a small quantity of sand.

Adjustment of the hydraulic loading rate of a separator will impact upon the balance of forces acting on a particle, which will in turn determine which sizes and densities of particle are separated, and which are not. Typically, as flow rates are reduced, particle removal rates tend to increase. The high fluid retention times that result from the flow motion described above correlate to the high levels of performance that are observed in practice, as particles have a long period of time within which to settle.



**Figure 2: Mean retention time predictions for different configurations of chamber (based on the average time for a neutrally buoyant particle to pass through the system)**

Research work has demonstrated that other more ‘conventional’ types of sedimentation system (e.g. rectangular tanks) tend to have shorter retention times, implying reduced treatment capabilities.



**Figure 3: CFD Predictions of Flow fields in an HDVS**

## **2.1 Hydrodynamic Separation In Practice**

### **The Importance of Internal Component Design**

Real flows tend to be far more complex than implied by some of the descriptions provided above. In particular, vortex flows, if not adequately controlled, can become unstable, which, in the context of a separation system, can actually be detrimental to performance? A known weakness of the original US EPA Swirl Concentrator was that material tended to settle out on the base, rather than passing to the extraction point at the centre (2). The modern systems of today, often termed 'advanced vortex separators', have evolved to overcome the difficulties mentioned above. Optimal design of the internal components helps to control flow patterns, so as to enhance the quality of separation performance. In the context of storm water treatment applications, a body of research has developed to demonstrate how internal components are important in ensuring that captured solids are not subsequently re-entrained and lost following their initial separation, a phenomenon that would appear to explain shortfalls in the performance of many alternative designs of system. The result of many years of evolution and refinement of hydrodynamic separator designs that the systems of today are both effective and economical, presenting potential for reduced land-take requirements, and hence reduced construction costs compared to other more conventional solutions.

## **3. OBJECTIVES**

The primary objective of this project is design and develop a robust Hydrodynamic Vortex Filter that can effectively filter rainwater contributed by the runoffs originating from all the environments such as roof tops, roadways, industrial or commercial complexes; and also which can be fitted in existing storm drain systems. The objective is branched into four parts.

- Analysis of rainwater collected from different points of origination that are evaluated and identified as effective regions for rainwater harvesting.
- Design of prototype with idealized parametric values of physical dimensions and required quality of resulting outflow.
- Optimization of the design for focused range of water quality output considering variations in inflow quality and quantity.
- Analysis of the resulting filtered water and evaluating the physical parameters in comparison to usage standards.

## **4. DESIGN CONSIDERATIONS**

- Match site considerations for physical dimensions of seating space of the filter as well as the catchment area of the runoff.
- Prevent re-suspension of particles by using small drainage areas and good maintenance.
- Retrofits should be designed to fit existing inlets.
- Placement should be accessible to maintenance with ease of cleaning filter media.
- If used as a part of Erosion and Sedimentation Control feeding to surface water sources, then entry grid grates have to be reconfigured and enough volume of sediment chamber is to be provided.
- Design for peak hydraulic capacity for average highest recorded rainfall measured in the site location and provide overflow provision so that storms in excess of the

device's hydraulic capacity bypass the treatment and is optionally filtered by equipment.

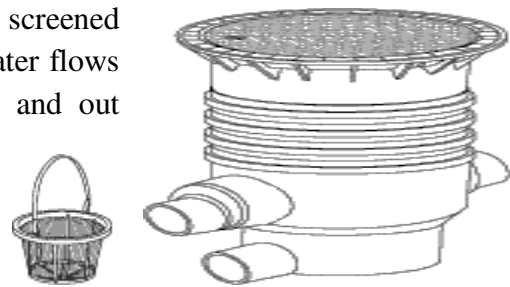
## 5. OPTIONAL STUDIES

### Comparison of optional methods

**First-Flush Diverters:** A First-Flush Diverter retains the initial runoff from a roof in a length of pipe that is capped at the end. When the pipe is filled, a ball or flapper shuts off the top of the pipe so that additional rainfall flows directly into the rainwater storage tank. The pipe caphas a small-diameter outlet that slowly releases the “first-flush” water so that by the next rain the pipe is empty and is ready to receive more water.

**Pot Filters:** A Pot Filter is the simplest rainwater pre-filters, simply a flanged plastic tray with a perforated bottom that covers the top of a large basin with a side outlet. A filter pad is placed over the perforations, the pad is covered with gravel, and the outlet is piped to a rainwater tank. Water from a downspout dumps onto the gravel which strains out leaves and coarse debris and then flows through the filter mat which retains solid particles as small as 1/64”. With minimal maintenance, a pot filter can capture and filter 100% of the rainwater from a single residential downspout. Normally Pot Filters are buried so that the top is flush with the ground surface, but they can be used above ground.

**Basket Filters:** A basket filter consists of a large screened filter basket that fits within a plastic filter body. Water flows in through a top port, down through the basket, and out through a bottom port. A second port is provided at the top to allow overflow should the filter basket become full. The basket is easily accessible through a removable manhole cover, and the burial depth is adjustable with a telescopic extension.

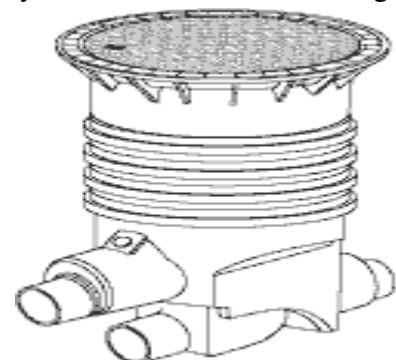


**Figure 4: Filter basket & Basket Filter**

**Cascade Filters:** In contrast with basket filters, Cascade Filters do not collect debris, but rather allow it to wash through the filter in order to minimize maintenance. This is achieved at the penalty of lower recovery rates, typically 95% depending on average rainfall intensity. Rainwater flows in through the top port and cascades over a curved, multi-level screened filter element positioned horizontally within a plastic filter body. Filtered water exits through one bottom port; debris is washed down the surface of the filter element and exits through a second bottom port. Similar to the Basket filters, the filter element in Cascade filters is easily accessible through a removable manhole cover, and the burial depth is adjustable with a telescopic extension.



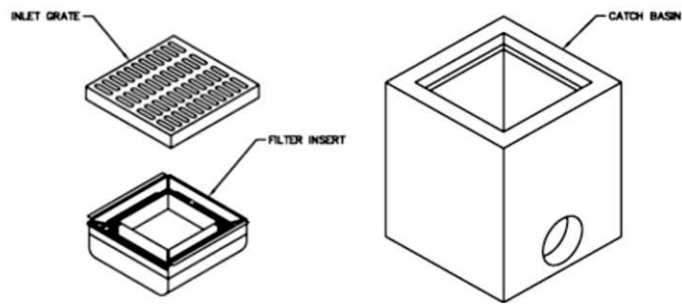
**Figure 5: Cascade filter element & Internal Cascade Filter**



**Figure 6: Cascade Filter**

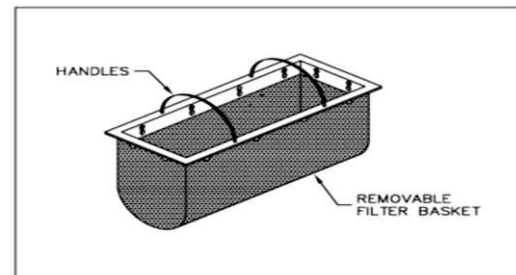


**Tray Types:** Tray type filter allows water to pass through filter media that is contained in a tray located around the perimeter of the inlet. Runoff enters the tray and leaves via weir flow under design conditions. High flows pass over the tray and into the inlet unimpeded.



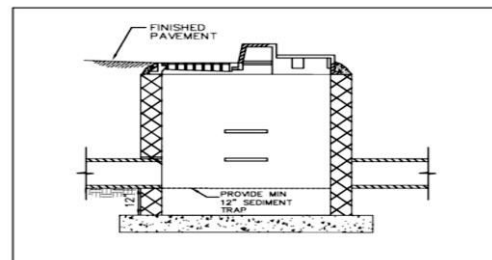
**Figure 7: Tray Type filter components**

**Bag types:** An Insert is made of fabric and is placed in the drain inlet around the perimeter of the grate. Runoff passes through the bag before discharging into the drain outlet pipe. Overflow holes are usually provided to pass larger flows without causing a backwater at the grate. Certain manufactured products include polymers intended to increase pollutant removal effectiveness.



**Figure 8: Stainless steel/Plastic filter bag**

**Simple, “sumps” in inlets:** Space is created in inlets below the invert of the pipes for sediment and debris to deposit, usually leaving 6-inches to 12-inches at the bottom of an inlet. Small weep holes should be drilled into the bottom of the inlet to prevent standing water for long periods of time. Regular maintenance is required.



**Figure 9: Sump type rainwater sedimentation plant**

## 6. ANALYSIS OF RUNOFFS

Since Hydrodynamic Vortex Filters are basically mechanical filters, all the physical and selected chemical parameters are analyzed. Water runoff samples were taken from focus locations and the following indicators of water quality was tested:

- i. **Water temperature:** Impinging solar radiation and atmospheric temperature brings about spatial and temporal changes in temperature, setting up convection currents and thermal stratification. Temperature plays a very important role in wetland dynamism affecting the various parameters such as alkalinity, salinity, dissolved oxygen, electrical conductivity etc. In an aquatic system, these parameters affect the chemical and biological reactions such as solubility of oxygen, carbon dioxide-carbonate-bicarbonate equilibrium, increase in metabolic rate and physiological reactions of organisms, etc. The temperature of drinking water has an influence on its taste.
- ii. **Turbidity:** Turbidity is an expression of optical property; wherein light is scattered by suspended particles present in water (Tyndall effect) and is measured using a

Nephelometer. Suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter; plankton and other microscopic organisms cause turbidity in water. Turbidity affects light scattering, absorption properties and aesthetic appearance in a water body. Increase in the intensity of scattered light results in higher values of turbidity.

- iii. **pH:** The effect of pH on the chemical and biological properties of liquids makes its determination very important. It is one of the most important parameter in water chemistry and is defined as  $-\log [H^+]$ , and measured as intensity of acidity or alkalinity on a scale ranging from 0-14. If free  $H^+$  are more it is expressed acidic (i.e.  $pH < 7$ ), while more  $OH^-$  ions is expressed as alkaline (i.e.  $pH > 7$ ). In natural waters pH is governed by the equilibrium between carbon dioxide/bicarbonate/carbonate ions and ranges between 4.5 and 8.5 although mostly basic. It tends to increase during day largely due to the photosynthetic activity (consumption of carbon-dioxide) and decreases during night due to respiratory activity. Waste water and polluted natural waters have pH values lower or higher than 7 based on the nature of the pollutant.
- iv. **Electrical Conductivity:** Conductivity (specific conductance) is the numerical expression of the water's ability to conduct an electric current. It is measured in micro Siemens per cm and depends on the total concentration, mobility, valence and the temperature of the solution of ions. Electrolytes in a solution disassociate into positive (cations) and negative (anions) ions and impart conductivity. Most dissolved inorganic substances are in the ionised form in water and contribute to conductance. The conductance of the samples gives rapid and practical estimate of the variation in dissolved mineral content of the water supply. Conductance is defined as the reciprocal of the resistance involved and expressed as mho or Siemen (s).
- v. **Total dissolved solids (TDS):** TDS is a measure of the combined content of all inorganic and organic substances contained in a liquid in molecular, ionized or micro-granular (colloidal sol) suspended form. Waters with high dissolved solids generally are of inferior palatability and may induce an unfavorable physiological reaction in the transient consumer.
- vi. **Total Suspended Solids:** Suspended solids are the portions of solids that are retained on a filter of standard specified size (generally  $2.0 \mu$ ) under specific conditions. Water with high-suspended solids is unsatisfactory for bathing, industrial and other purposes.
- vii. **Total Hardness:** Hardness is predominantly caused by divalent cations such as calcium, magnesium, alkaline earth metal such as iron, manganese, strontium, etc. The total hardness is defined as the sum of calcium and magnesium concentrations, both expressed as  $CaCO_3$  in mg/L. Carbonates and bicarbonates of calcium and magnesium cause temporary hardness. Sulphates and chlorides cause permanent hardness.
- viii. **Colour:** In natural water, colour is due to the presence of humic acids, fulvic acids, metallic ions, suspended matter, plankton, weeds and industrial effluents. Colour is removed to make water suitable for general and industrial applications and is determined by visual comparison of the sample with distilled water.

- ix. **Taste and Odor:** The smell of water often gives some indication of its character. Generally, odor and taste are present in combination when water is sampled from runoffs for testing. The primary sources of taste and odor problems in runoff water are biological contaminants that originate from domestic and industrial wastes. However, other anthropogenic sources such as wastewater discharges and chemical spills also act as sources of chemicals that cause off tastes and odors. Such chemicals can affect both water quality and rainwater harvesting system equipments. In most cases, water runoff paths traverse on a number of naturally occurring compounds and minerals such as calcium, iron and magnesium in varying concentrations that have an effect on the waters' taste.

## 7. RESULTS OF RUNOFF WATER TESTS

**Table 1: Pre-filtration Physico-Chemical parameters of various runoff sites**

Parameters	Unit	Non Metal Roof (asbestos sheet/concrete)	Zinc sheeted roof	Parking lot, Residential Street	Main traffic road	Heavy Industries site	Playing field (Stadium/Golf Course)
Temperature	°C	26	25	27.5	28	27	26.5
Turbidity	NTU	28	16	267	330	358	223
pH	[-]	7.7	7.5	8.0	8.2	8.7	7.9
Electrical Conductivity	μS/cm	97	73	323	489	425	206
Total Dissolved Solids (TDS)	mg/L	122	89	176	862	647	263
Total Suspended Solids	mg/L	72	42	103	492	325	155
Total Hardness	ppm	19.20	3.85	178.4	194.2	201.6	136.3
Colour	HU	109	86	563	672	800	479
Taste	[-]	Bitter	Bitter	Not permissible	Not permissible	Not permissible	Not permissible
Odor	[-]	Not recognizable	-	Solvent-like,	Gasoline, Sulfurous	Earthy (trace Medicinal)	Grassy, Earthy



**Figure 10: Oil spill and films flowing with rainwater runoff**

## Particle Size Distribution of Runoff Sediments

Table2: Runoff Sediments particle size distribution

Particle Size Microns	Sandy Loam (percent by Mass)
500-1,000 (coarse sand)	5.0
250-500 (medium sand)	5.0
100-250 (fine sand)	30.0
50-100 (very fine sand)	15.0
2-50 (silt)	(8-50 $\mu\text{m}$ , 25%) (2-8 $\mu\text{m}$ , 15%)*
1-2 (clay)	5.0

## 8. FORMULAE

### Rainwater Harvesting Formulae Used in Determining the Dimensions of Materials

- a) Possible volume of runoff from a roof or other impervious Catchment Area (metric units):

$$\text{Catchment area (m}^2\text{)} \times \text{Rainfall (mm)} = \text{Maximum runoff (litres)}$$

- b) Estimated Net Runoff from an Impervious Catchment Surface Adjusted by its Runoff Coefficient (metric units):

$$\text{Catchment area (m}^2\text{)} \times \text{rainfall (mm)} \times \text{runoff coefficient} = \text{Net runoff (litres)}$$

- c) Storage Capacity of a Square or Rectangular Tank (metric units):

$$\text{Length (cm)} \times \text{width (cm)} \times \text{effective height (cm)} \div 1,000 \text{ cm}^3/\text{litre} = \text{Capacity (litres)}$$

- d) Weight of Stored Water (metric units):

$$\text{Stored water (litres)} \times 1 \text{ kg/litre} = \text{Weight of stored water (kg)}$$

### Mechanical Formulae Used in Determining the Dimensions of Materials

- a) Inflow Pipe Diameter:

$$D = \sqrt{\frac{4 \times \text{flow rate}}{\pi \times \text{velocity}}}$$

D – Diameter of pipe

- b) Particle Settling Velocity:

$$V_s = \sqrt{\frac{4dg[\rho_p - \rho_f]}{3C_d\rho_f}}$$

$V_s$  – particle settling velocity (m)

$g$  – acceleration due to gravity ( $\text{m/s}^2$ )

$d$  – particle diameter (m)

$\rho_f$  – fluid density ( $\text{kg/m}^3$ )

$\rho_d$  – particle density ( $\text{kg/m}^3$ )

$C_d$  – drag coefficient

- c) Bursting Strength: (Filter body under fluid pressure)

$$P = \frac{2ST \times 0.006894}{D_o \times FOS}$$

$P$  – fluid pressure (MPa)

$S$  – ultimate tensile strength of material

$T$  – thickness of the cylinder

$D_o$  – outer diameter of cylinder



FOS – factor of safety

d) **Rate of Loading:**

$$V_a = \frac{Q}{A_s}$$

$V_a$  – face velocity (m/d), loading rate ( $\text{m}^3/\text{d.m}^2$ )

$Q$  – flow rate into filter surface

$A_s$  – area of filter surface

e) **Stoke's equation: (velocity of oil during separation)**

$$V = \frac{2gr^2(d_1 - d_2)}{9\mu}$$

$V$  – velocity of rise ( $\text{cm/s}^2$ )

$g$  – acceleration due to gravity ( $\text{cm/s}^2$ )

$r$  – equivalent radius of particle (cm)

$d_1$  – density of particle ( $\text{g/cm}^3$ )

$d_2$  – density of medium ( $\text{g/cm}^3$ )

$\mu$  - viscosity of medium ( $\text{dyne.sec/cm}^2$ )

## 9. DESIGN OF EXPERIMENTS

The experiments were conducted for different flow rates, turbidity, sediments mass flow rate and percent of oil combinations. The flow rates considered are 0.5 Cu.ft/s, 1.0 Cu.ft/s, 1.5 Cu.ft/s and 2.0 Cu.ft/s. Turbidity considered are 100 NTU, 200 NTU and 300 NTU and 400 NTU. The sediments mass flow rate considered are 5 kg/m<sup>3</sup> s, 10 kg/m<sup>3</sup> s, 15 kg/m<sup>3</sup> s and 20 kg/m<sup>3</sup> s and percent of oil/grease elements are 0.003%, 0.006%, 0.009% and 0.012%. Diameter of filter composite surface area considered is 500mm. In all the water conditions for each combination of muddy water are measured using suitable devices respectively.

### 9.1 Selection of Control Factor and Orthogonal Array (OA)

The Taguchi method is used to find optimal values of the objective function in manufacturing processes. Compared to traditional experimental designs, the Taguchi method makes use of a special design of OA to examine the quality characteristics through a minimal number of experiments. The selection of which OA to use predominantly depends on the following items, in order of priority:

1. The number of factors and interactions of interest.
2. The number of levels for the factors of interest.
3. The desired experimental resolution, or cost limitations.

In the Taguchi method, OA's can provide an effective experimental performance with a minimum number of experimental trials. Taguchi proposes the use of OA's for planning the design/process optimization experiments. The choice of OA is very critical, as it depends on the number of factors to be studied for optimization, the number of levels required for each factor, the objective of the experiment, and of course, the availability of experimental budget and resources. In order to guarantee that the chosen OA design will provide sufficient degrees of freedom for the proposed experiment, the following inequality must be fulfilled:

Number of degrees of freedom for OA  $\geq$  Number of degrees of freedom required for studying the main, and interaction effect.

**Table 3: Inflow Runoff water parameters and levels**

Water Parameters	Level 1	Level 2	Level 3	Level 4
Flow Rate (Cu.ft/sec)	$F_1 = 0.5$	$F_2 = 1.0$	$F_3 = 1.5$	$F_4 = 2.0$
Turbidity (NTU)	$T_1 = 100$	$T_2 = 200$	$T_3 = 300$	$T_4 = 400$
Sediments Mass flow rate( $\text{kg/m}^3 \text{ s}$ )	$S_1 = 5$	$S_2 = 10$	$S_3 = 15$	$S_4 = 20$
Percent of Oil/Liter of Water	$P_1 = 0.003$	$P_2 = 0.006$	$P_3 = 0.009$	$P_4 = 0.012$

In this study, resulting water status was measured via the experimental design theoretical model simulator for each combination of the control factors. Determination of the quality characteristics of the measured control factors are provided by removal efficiency.

**Table 4: Orthogonal array (Level 1 of Flow rate)**

Run	Flow rate	Turbidity (NTU)	Sediments Mass Flow Rate	Percent of Oil
1	1	1	1	1
2	1	1	1	2
3	1	1	1	3
4	1	1	1	4
5	1	1	2	1
6	1	1	2	2
7	1	1	2	3
8	1	1	2	4
9	1	1	3	1
10	1	1	3	2
11	1	1	3	3
12	1	1	3	4
13	1	1	4	1
14	1	1	4	2
15	1	1	4	3
16	1	1	4	4
17	1	2	1	1
18	1	2	1	2
19	1	2	1	3
20	1	2	1	4
21	1	2	2	1
22	1	2	2	2
23	1	2	2	3
24	1	2	2	4
25	1	2	3	1
26	1	2	3	2

27	1	2	3	3
28	1	2	3	4
29	1	2	4	1
30	1	2	4	2
31	1	2	4	3
32	1	2	4	4
33	1	3	1	1
34	1	3	1	2
35	1	3	1	3
36	1	3	1	4
37	1	3	2	1
38	1	3	2	2
39	1	3	2	3
40	1	3	2	4
41	1	3	3	1
42	1	3	3	2
43	1	3	3	3
44	1	3	3	4
45	1	3	4	1
46	1	3	4	2
47	1	3	4	3
48	1	3	4	4
49	1	4	1	1
50	1	4	1	2
51	1	4	1	3
52	1	4	1	4
53	1	4	2	1
54	1	4	2	2
55	1	4	2	3
56	1	4	2	4
57	1	4	3	1
58	1	4	3	2
59	1	4	3	3
60	1	4	3	4
61	1	4	4	1
62	1	4	4	2
63	1	4	4	3
64	1	4	4	4

## 9.2 Design of Hydrodynamic Vortex Rainwater Filter

The 3D modeling and assembly design of the entire unit was prepared in Dassault Systems CATIA on the basis of collected data from the theoretical calculations & analysis and selected

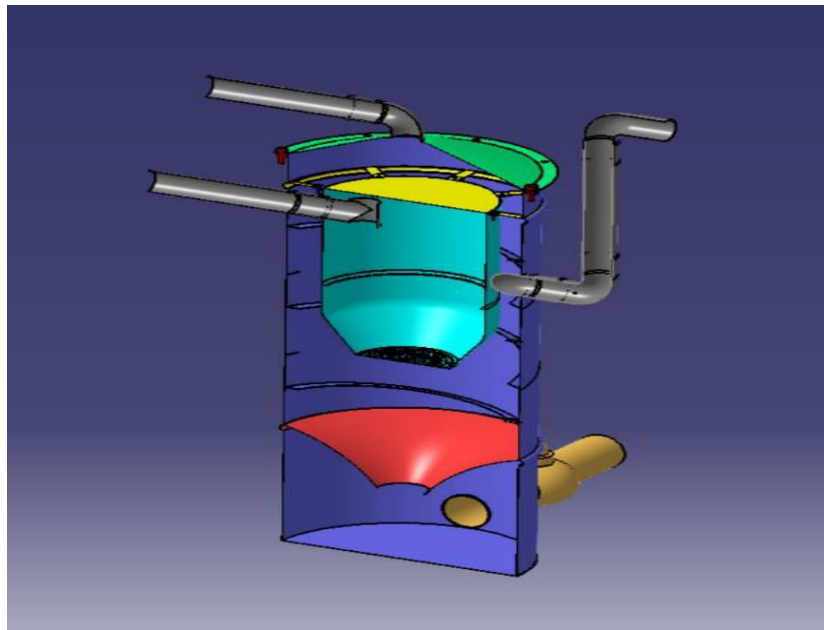
materials. The assemble model is shown in the Fig.11. Before a final design of the water filter was created, it was necessary to ensure that the filter works as described. Several filters models were made to determine the filter effectiveness and flow rate using different concepts and flow paths. The first step in designing the filter is to determine the seating space provided for the equipment in most of the locations. The targeted locations allowed a maximum lateral space of 1000mm and longitudinal space of 2000mm. Since the pipe fitting for water inlet and outlet with flush system and oil elements discharge is to be spaced with in the allowed volume of seating chamber, the filter body has to be slender but sizeable enough for the process to occur inside.

The second step of the design is to evaluate the pipe diameter to facilitate the flow rate of inflow as well as the out flow of the filtered water without building up the pressure even during the peak loads that can exceed the allowable pressure capacity of the pipe as well as the body material. The calculation of the pipe diameter with respect to rate of discharge fairly allows the designer to even determine the material of the pipe that is to be selected and the space requirements of the pipe as well. The next tread level in designing the filter is the most important aspect of the entire process, i.e., establishing the flow path of the storm water with in the space of the filter. This step is done in two parts. In the first, the behavior of the suspended and quick settling particles is scrutinized when subjected to hydrodynamic forces in vortex direction. The particles behavior is studied with iterations in speeds and flow rate values of water vortices in a transparent container. This study is utilized for determining the dimension of the space required for hydrodynamic flow in the filter body and that of the hole that is to be provided for silt trap funnel. In the second part the loading factor for filter media is evaluated with varying amounts of suspended particles. This is to decide on the surface area of the filter media to be provided to meet the targeted value of filtration without re-suspending the particles during high loads.

A cumulative decision is made after studying both parts of the third step of designing. This results in precise dimensions that are to be provided to the body and the filter chamber where the filter media is located. It also gives a solution to the flow path of the water, where the hydrodynamic vortex flow occurs exterior to the filter chamber and the later the water enters the filter chamber from bottom; also called up-flow. For the water to flow in a vortex direction smoothly even during lowest flow rates, fin like protrusions spiraling towards the bottom is provided inside the hydrodynamic flow space. Each of the spiraling fins is designed with precise horizontal orientation in the top end (starting edge) to gradual inclination towards upside at the bottom edge. These fins not only direct the water to the bottom portion of the filter but the gradual inclination in them foster the oil/grease elements to surface. They act as parallel plate coalesce typically used in oil water separators of conventional models.

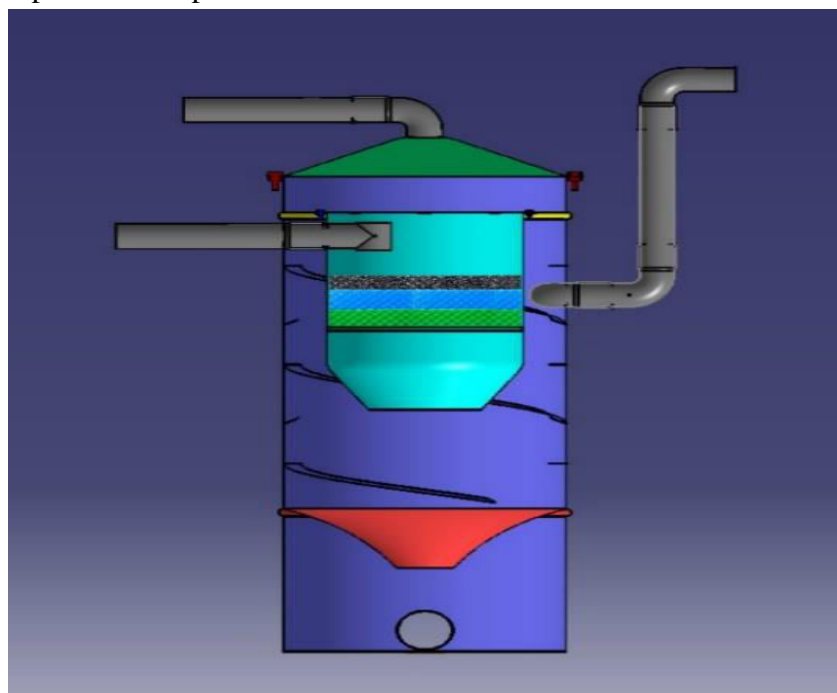
The filter chamber is designed in a fashion with a smaller entry area than the lateral area of the chamber to provide a smaller entry point for the water and prevent the heavier sediment particles to enter in it. This also provides larger volume for the vortex base of the hydrodynamic flow which enhances the trapping capacity of the sediment particles.





**Figure 11: Isometric Sectional view of Filter assembly (without filter composite media)**

The oil outlet pipe is designed to be assembled in the top section of the unit because it being lighter rises to the water surface. The water pressure below the oil layer pushes it to the top which in turn discharges it. To enhance the collection of and easily flow of oil/grease the top cover plate is taper toward upside.



**Figure 12: Sectional view of Filter assembly (with filter composite media in filter chamber)**

The final step of the design process it to provide the unit with suitable sludge flush system which can be easily operated and effective. This also should provide enough space to clean and wash through the silt trap for stubborn patches of sediment which form lumps during long periods of inactivity.

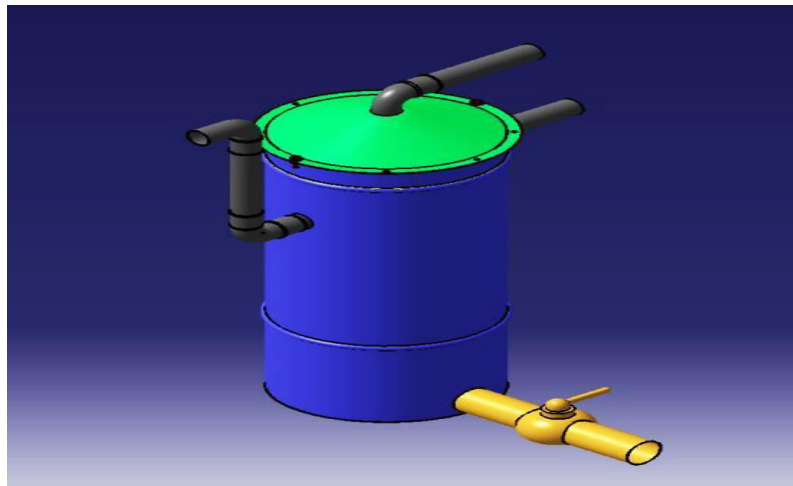


Figure 13: Isometric whole view of Hydrodynamic Vortex Filter

### 9.3 Properties of Materials used in Construction of Filter

Steel is cheap, hard, and fairly durable and because most of the pollutants of rainwater runoff are relatively corrosive in nature a resistant material is needed during construction of rainwater filter. Stainless steel is one of the materials which presents as a solution. This alloy has different metals which help reduce corrosion or rust when placed in water for a length of time. As opposed to high carbon steel it is preferred by engineers throughout the world because it is persistent to oxidation coat. The Stainless steel grade called Type 305 is particularly chosen as its properties concur to the required parameters and due to its ease of workability.

- i. **Description:** Type 305 Stainless Steel is an austenitic chromium nickel stainless steel with a low rate of work hardening. This low rate of work hardening makes it suitable for many deep drawing applications. In order to minimize earring during drawing, the directionality introduced during cold rolling must be kept to a minimum amount. Deep drawing quality should be noted when ordering this alloy. Type 305 is non-magnetic and becomes magnetic (at slow rate) with increasing cold work.
- ii. **Composition**

Table 5: Stainless steel Type 305 alloy composition

Elements	Weight Percent
Carbon	0.12 max
Manganese	2.00 max
Phosphorus	0.045 max
Sulfur	0.030 max
Silicon	1.00 max
Chromium	17.00 – 19.00
Nickel	10.00 – 13.00
Molybdenum	0.75 max
Copper	0.75 max
Iron	Balanced

iii. **Physical Properties:**

Table 6: Stainless steel Type 305 physical properties

Density (kg/m <sup>3</sup> )	7990
Electrical Resistivity (μΩ.cm) (28.4 °C)	72
Thermal Conductivity (W/m/K)	
100 °C	16.2
500 °C	21.4
Mean Coefficient of Thermal Expansion (μm/m/K)	
0 – 100 °C	17.3
0 – 315 °C	17.8
0 – 538 °C	18.4
0 – 649 °C	18.7
Modulus of Elasticity (MPa) (in tension)	193 x 10 <sup>3</sup>
Magnetic Permeability Annealed (H/m at 200 Oersteds)	1.02 max
Specific Heat (kJ/kg/K)	0.50
Melting Range (°C)	1399 – 1454

- iv. **Corrosion Resistance:** Type 305 offers good protection from a wide variety of solutions used in the chemical, textile, petroleum, dairy and food industries. Annealed Type 305 Stainless is resistant to atmospheric corrosion, sterilizing solutions, many organic chemicals and wide variety of inorganic chemicals. If the material is heated between 427 °C and 899 °C or cooled slowly through that range, intergranular corrosion may be a problem and a carbide network may form at the grain boundaries, thereby decreasing corrosion resistance. Annealing, followed by rapid cooling, alleviates the situation. Type 305 provides good oxidation resistance in air up to about 899 °C, and can be used for intermittent exposure to about 816 °C. For optimum corrosion resistance, surfaces must be free of scale, lubricants, foreign particles, and coatings applied for drawing and heading. After fabrication of parts, cleaning and/or passivation should be considered.

#### 9.4 Selection of Filter Media

Filter media is anything placed in a filter that changes the quality of water flowing through it. With the variety of medias available, specific types can be chosen to obtain the optimum filtration of runoff water. There are three types of filter media are:

- Mechanical
- Biological
- Chemical

The three types of filtration utilize three different types of media to perform their functions. All three types are recommended in a filter, but a Pretank filter needs to have chemical and

mechanical filters at minimum. Components of these media types can be incorporated in the same filter.

- i. **Mechanical Media:** The components of mechanical media are inert - this means that the material this media is made of will do nothing to interfere with the water chemistry. This media mechanically or physically strains solids from water passing through it, which is vital for the efficiency of the chemical media. Mechanical media is available in much different porosity, which controls the size of the particulate that it can extract. The larger the pores in the mechanical media, the larger the particulate matter must be in order for the filter to extract it. There are two layers of mechanical filter media involved in the filter composite. The bottom most layer is the first layer to which the water first comes in contact and it effectively strains out particle size up to the range of 150-200 microns. This media is known as coarse media which has pores density of 30 ppi and is easier to clean and reuse than finer media. The finer media forms the second layer which clarifies the water further, filtering out the particle size in the range of 10-20 microns. Since this layer is very vulnerable to clogging in shorter periods the coarse media acts as the protecting layer.
- ii. **Chemical Media:** Chemical media such as poly filter are effective at removing a variety of impurities, such as copper, chlorine, dissolved proteins, medications, or tap water impurities by binding these unwanted materials and trapping them within the media. Activated carbon resins, and other adsorbent chemical media bind and remove dissolved particulates from the water column through the process of adsorption. The two most popular forms of chemical media are activated carbon and resins. Since Activated charcoal is the most economic and widely available filter material, it is chosen as the third layer of the filter composite. Activated carbon/charcoal is filled with microscopic pores that cause certain organic or inorganic materials to stick to them. Since it forms the top most layers and has comparatively more buoyancy than sand or stone particles, larger size of charcoal granules of range 15-25 mm is opted to avoid them from floating and draining into the outlet pipe. Carbon removes many harmful elements from water, such as cadmium, zinc, heavier dissolved salts and hydrocarbons.

### 9.5 How it Works

- i. The rainwater from the connected area is fed into the central section of the filter housing. The angled inlet generates a radial flow pattern.
- ii. The hydrodynamic separator converts turbulent waters into a radial laminar flow pattern, generating particle sedimentation, particularly of the sand fraction. The oil/grease element since being lighter than water floats to the top portion of the shaft and is discharged from the top outlet.
- iii. This takes place through an inlet to the exterior section of the filter shaft. The sediment is retained in a silt trap chamber below the separator. The silt trap can be flushed for cleaning, and has an integral cleaning outlet to the side to ease dirt removal.



- iv. In the inner chamber of the filter housing is the actual filtering area. The filter composite elements filter out the fine materials in an up-flow process and dissolved materials are precipitated and adsorbed. The filter is backwashed from above. When exhausted the filter is easily exchanged.
- v. The filter chamber can be easily pulled up and the filter composite is removed from the shaft housing.

#### **9.6 Technical data**

- Inner diameter of Filter body: 560mm
- Height of the filter unit: 1350mm
- Inlet and Outlet Pipe diameter: 75mm
- Minimum head loss between inlet and outlet: 25 cm
- Connectable area: 10000 to 45000 sq.ft(according to site conditions)
- Maximum flowrate: 3 cfs, filterable flowrate: 2.6 cfs
- Sludge flush Pipe diameter: 150 mm
- Filter composite exchange interval 3 to 5 years

#### **9.7 Limitations**

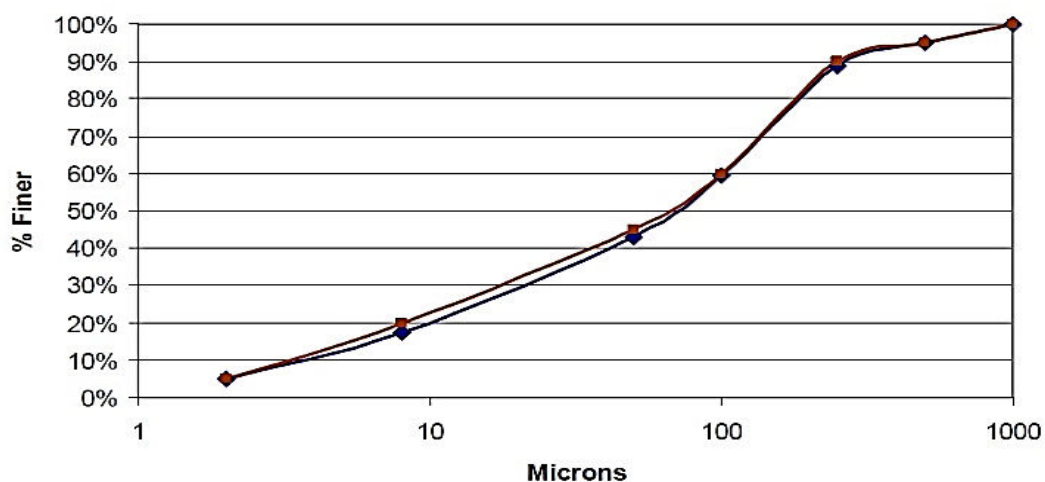
- i. **Factors Causing Under-Performance:** If the Hydrodynamic Vortex Filter is designed and installed correctly, there is minimal possibility of failure. There are no moving parts to bind or break, nor are there parts that are particularly susceptible to wear or corrosion. Lack of maintenance may cause the system to operate at a reduced efficiency, and it is possible that eventually the system will become filled with sediment up to the lower edge of the vortex tubes, blocking flow. When a Hydrodynamic Vortex Filter unit is newly installed, frequent inspection is highly recommended. The design of this filter unit permits easy inspection. It is recommended that during the first two years after installation, inspection be performed at least quarterly for the purpose of noting the rate of sediment and floatables accumulation.
- ii. **Pollutant Transformation and Release:** The Hydrodynamic Vortex Filter will not increase the net pollutant load to the downstream environment. However, pollutants may be transformed within the unit. For example, organic matter may decompose and release nitrogen in the form of nitrogen gas or nitrate. These processes are similar to those in wetlands but probably occur at slower rates in the filter due to the absence of light and mixing by wind, thermal inputs and biological activity. Accumulated sediment should not be lost from the system at or under the design flow rate.
- iii. **Sensitivity to Heavy Sediment Loading:** Heavy loads of sediment will increase the needed maintenance frequency.
- iv. **Mosquitoes:** Although the Hydrodynamic Vortex Filter is a self-contained unit, the design does incorporate standing water in the lower chamber, which can be a breeding site for mosquitoes. It is supplied with a gasket petroleum industry rated access cover to better address these issues.

## 10. RESULTS

The Hydrodynamic Vortex Pretank Rainwater Filter removes substantial amount of pollutants from runoffs origin of various locations. The quality of post filtration water is tested for the same Physico-Chemical parameters that have been considered in the test of runoff water earlier. The results are shown below in Table 7.

**Table 7: Post Filtration rainwater Physico-Chemical parameters of various runoff sites**

Parameters	Unit	Non Metal Roof (asbestos sheet/concrete)	Zinc sheeted roof	Parking lot, Residential Street	Main traffic road	Heavy Industries site	Playing field (Stadium/Golf Course)
Temperature	°C	24	24	25	26.5	25.5	25.5
Turbidity	NTU	5	2	13	16	21	10
pH	[-]	7.7	7.5	8.0	8.2	8.5	7.9
Electrical Conductivity	μS/cm	90	68	298	462	380	186
Total Dissolved Solids (TDS)	mg/L	55	42	89	668	555	156
Total Suspended Solids	mg/L	19	8	21	28	25	21
Total Hardness	ppm	19.20	3.85	178.4	194.2	201.6	136.3
Colour	HU	21	15	45	62	84	53
Taste	[-]	Slight bitter	Not Recognizable	Bitter	Bitter	Bitter	Slight Bitter
Odor	[-]	No	No	No	No	No	No



**Figure 14: Filter Composite filtering capacity**

The following are the data obtained from real world situation for comparison and correlate the filtration capacity of this filter and assess it robustness.

- Average rainfall in India is 0.8 inch/hr
- Average highest rainfall in India is 1.909 inch/hr
- Average peak time rainfall of the highest rainfall place in the world, Cherapunji is 3.968 inch/hr (in July)a .The result of simulation of the designed filter model in theoretical model simulator for an area of 30000 sq.ft is given below.

Rainfall Intensity <sup>1</sup> (in/hr)	% Total Rainfall Volume <sup>1</sup>	Cumulative Rainfall Volume	% Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0200	3.47%	3.47%	3.47%	0.0124	0.0124	0.09%	100%	3.47%
0.0400	3.42%	6.89%	3.42%	0.0248	0.0248	0.18%	100%	3.42%
0.0600	3.89%	10.78%	3.89%	0.0373	0.0373	0.27%	100%	3.89%
0.0800	3.48%	14.26%	3.48%	0.0497	0.0497	0.36%	100%	3.48%
0.1000	3.72%	17.98%	3.72%	0.0621	0.0621	0.44%	100%	3.72%
0.1200	3.23%	21.21%	3.23%	0.0745	0.0745	0.53%	100%	3.23%
0.1400	3.12%	24.33%	3.12%	0.0869	0.0869	0.62%	100%	3.12%
0.1600	3.13%	27.46%	3.13%	0.0994	0.0994	0.71%	100%	3.13%
0.1800	2.79%	30.25%	2.79%	0.1118	0.1118	0.80%	100%	2.79%
0.2000	2.94%	33.19%	2.94%	0.1242	0.1242	0.89%	100%	2.94%
0.2500	5.83%	39.02%	5.83%	0.1553	0.1553	1.11%	100%	5.83%
0.3000	5.71%	44.73%	5.71%	0.1863	0.1863	1.33%	100%	5.71%
0.3500	4.90%	49.63%	4.90%	0.2174	0.2174	1.55%	100%	4.90%
0.4000	4.04%	53.67%	4.04%	0.2484	0.2484	1.77%	100%	4.04%
0.4500	4.89%	58.56%	4.89%	0.2795	0.2795	2.00%	100%	4.89%
0.5000	3.87%	62.43%	3.87%	0.3105	0.3105	2.22%	100%	3.87%
0.7500	11.44%	73.87%	11.44%	0.4658	0.4658	3.33%	100%	11.44%
1.0000	9.98%	83.85%	9.98%	0.6210	0.6210	4.44%	100%	9.98%
1.5000	8.21%	92.06%	8.21%	0.9315	0.9315	6.65%	100%	8.21%
2.0000	3.79%	95.85%	3.79%	1.2420	1.2420	8.87%	99.64%	3.78%
2.5000	2.38%	98.23%	2.38%	1.5525	1.5525	11.09%	99.19%	2.36%
3.0000	1.21%	99.44%	1.21%	1.8630	1.8630	13.31%	98.75%	1.19%
4.0000	0.00%	99.44%	0.00%	2.4840	2.4840	17.74%	97.86%	0.00%
0.0000	0.00%	99.44%	0.00%	0.0000	0.0000	0.00%	100%	0%
								99.39%
Removal Efficiency Adjustment2 =								6.45%
Predicted % Annual Rainfall Treated =								92.99%
Predicted Net Annual Load Removal Efficiency =								92.94%

Figure 15: Hydrodynamic Vortex Filter simulated test efficiency for 30,000 sq.ft catchment area.



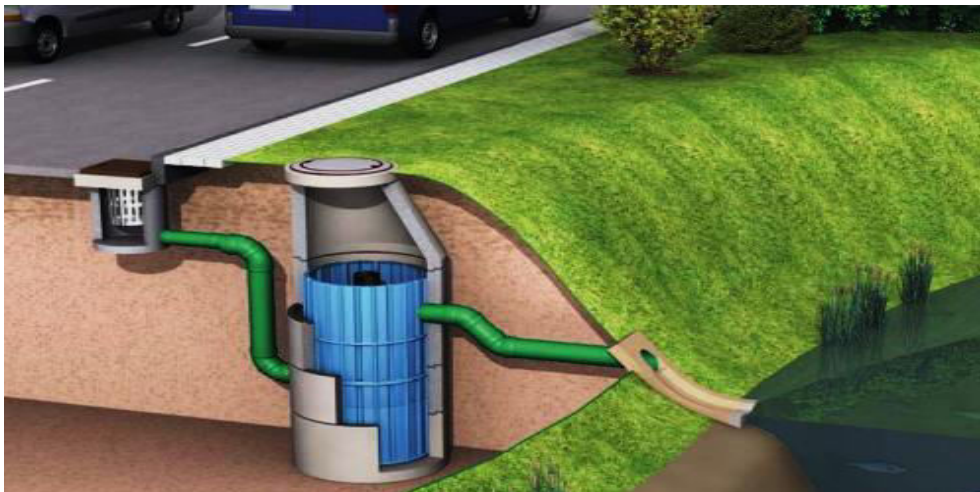


**Figure 16: Pre and Post filtration rainwater (Playing Field)**

The simulation result clearly shows that the filter has the capacity to satiate the real world situations of even the highest rainfall conditions in the world with a negligible deviation in the water output quality and efficiency. This represents the advantage of using the concepts of Robust Design and Design of Experiments which enhances the abilities of the designer during the designing process of prototype models.

## 11. CONCLUSION

Decentralized storm water treatment is state of the art because it reduces the costs for urban drainage by using source control. This filtration unit has numerous advantages in comparison with other systems. The system combines a hydrodynamic separator with a filter unit, which is easy to inspect and maintain. There is only low head loss. Filter media is kept in chamber, where there is no loose of material in the system. Filter media has to be replaced in intervals between 3 and 5 years depending on the sites conditions. There is virtually no footprint because the system can be installed below car parks or roads.



**Figure 18: Integration of Hydrodynamic Vortex Filter for traffic highways purpose (post filtration rainwater feed to surface storage reservoir)**

The filter media removes pollutants like suspended particles, hydrocarbons and heavy metals. Furthermore, it binds phosphorous and ammonium from storm water runoff. The two step



treatment train separates solids and dissolved substances (partly). The system is ideal for car parks, roads, industrial areas and even metal roofs. Highest pollutant levels in storm water runoff can be reduced to acceptable loads for storage tanks, groundwater and surface waters. The modular design allows the adaption to nearly any site condition.



**Figure 17: Integration of Hydrodynamic Vortex Filter for residential purpose.**

Through this project we concluded that the Hydrodynamic Vortex Pretank Rainwater Filter is an essential attachment/inclusion when a rainwater harvesting system is constructed, for any given location, for good water quality and maintaining the same during storage. This project will be helpful by providing better means of rainwater harvesting system after careful analysis of study area and application of suitable scientific technique to fulfill the demand of current generation and to retain the sustainability of the future generation. It will also help in the development of the nation.

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### Author's Brief Biography



**S.V. Tarun** graduated from Visvesvaraya Technological University with a Bachelor's degree in Mechanical Engineering and later worked as freelance product designer, during which time he has developed several products relating to diverse fields and published many research papers in International Journals. He became the founding member of a chapter of Fluid Power Society of India during his undergraduate degree. A born artist, combined with engineering skills evolved his interests towards innovating designs of contemporary products and development of new concepts in the field of sustainable industrial operations & management. A young Engineer and an aspiring Technological Entrepreneur, he is currently on an assignment with a mini-cement plant and associates part time in research activities with the Department of Mechanical Engineering of JSSATE, Bangalore, his alma mater.



**Prof. G.M. Swamy** came into academics fifteen years ago after a stint of five years of industrial experience. An alumnus of Sri Jayachamarajendra College of Engineering, Mysore, he completed both his Bachelors and Master's degree in Mechanical Engineering there. He is a member of Indian Society for Technical Education and International Association of Engineers. During his service in academics he has published several research papers and have partaken in numerous National and International Conferences where he was also present as the chairperson. He is currently serving as an Assistant Professor in the Department of Mechanical Engineering, JSS Academy of Technical Education, Bangalore, along with perceiving his Doctorate degree in the field of Non-destructive Tool Testing under a noted metallurgical expert Dr. Shankargoud N.

# Comparative Study And Implementation Of DB & DBB Method For Construction Management Application Using Statistical Tools

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<b>Keywords</b>	Construction Management Application, Building Construction, Project Size, Complexity, Innovation, Uncertainty, Urgency				

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## Abstract

*The demand on building construction has been becoming increasingly more complicated, more varied, and bigger. Technology intensive construction projects rather than simple labour-intensive projects are increasing in number. For implementation of any construction project every owner has responsibility regarding method by which project is designed and constructed. Therefore decision regarding a project delivery method is complicated. A motivation behind this study is to find out which project delivery method performs at a higher level in terms of cost, time, and quality. A different project delivery method elaborate role and responsibility of person involved in project and how owner pay for services.*

## 1. INTRODUCTION

Construction sector is diverse as it contains contractors, consultants, designers, owners, and others. Construction projects suffer various problems and complex factors such as cost, duration, quality and safety. There are undue cost overruns, delays and loss of productivity



associated with construction projects everywhere. In today's era, one of the biggest concerns for any organization is to improve their productivity, representing the effective and efficient conversion of resources into marketable products and determining business profitability. With the business environment becoming highly competitive, it is essential that organizations improve construction productivity performance for survival.

Now there are different types of project delivery methods available to owner. It is an important for specific project to select an appropriate method of project delivery. Contractual relations, contemporary laws and regulations, owner's perception of risks, awarding mechanisms and the method of payment all contribute to project delivery method selection. Selection of the project delivery system is one of the most important decisions affecting the success of a project. Project size, complexity, innovation, uncertainty, urgency and the degree of Owner involvement all affect delivery method selection and the difficulty of achieving the required results.

## 2. LITERATURE REVIEW

- **Sanvido and Konchar** carried out study on Project delivery system in his paper entitled as, "Comparison Of U.S. Project Delivery Systems". The main aim of paper was to study and compare different project delivery methods used in United States. Design-build, design-bid-build, Construction management at risk were three project delivery methods were studied. According to his study, "Cost was defined as the design and construction cost of the base facility and did not include land acquisition, extensive site work, and process or owner costs. The three cost measures were unit cost, project cost growth, and intensity." The time aspect was defined as "the total as planned time," and was calculated from the planned start date to the planned construction end date. And quality was defined as, "Quality was recorded separately for the turnover process and for the performance of specific systems.
- **C. William Ibbs et al.** presented a research paper titled 'Project Delivery Systems and Project Change: Quantitative Analysis. He compared the effectiveness of an alternative project delivery method D/B with the traditional project delivery method D/B/B. paper examined the relationship between impacts on project change by applying different project delivery approaches. Performance data -cost, schedule, and productivity from the Construction Industry Institute -CII were used to compare the average amounts of change for two different project delivery strategies D/B and D/B/B.
- **Wardani et al.** presented their study, "Comparing Procurement Methods for Design-Build Projects." This research on the procurement method of project delivery systems is important as the for delivery method itself. The data analysis indicated several important trends associated with different performance metrics. Results from this study showed that the low-bid selection process had the highest cost growth, which was 9% higher than the qualifications-based procurement method. This study showed that schedule growth from the best value procurement method had an average of 0% schedule growth. Therefore, even though the DB delivery method can possibly lead to superior project performance,



the procurement methodology used to select the DB firm should be evaluated very carefully prior to advertising.<sup>[3]</sup>

- The study, conducted by **Rojas and Kell** in his paper entitled as, “Comparative Analysis Of Project Delivery Systems Cost Performance In Pacific Northwest Public Schools”, looked at 297 school projects .The focus of the study was to determine whether CM at-Risk was better at controlling costs when compared to Design-Bid-Build although much of the analysis did not result in statistically significant results, observable evidence was obtained. The analysis of cost control revealed that CM at-Risk did not outperform Design-Bid-Build; however, only 8% of the total projects in the study were CM at-Risk.<sup>[4]</sup>
- **Adetokunbo A. etal.** presented their study, ‘Relative Effectiveness of Project Delivery and Contract Strategies’. This paper provides Multi criteria decision analysis techniques which is suitable approach for a quantitative, analytical evaluation of project delivery systems. It reviews several analysis methods for evaluating alternative project delivery systems for the purpose of identifying an optimal solution for any given project. Several methods are methods considered included genetic algorithms, statistical decision theory and multi criteria decision analysis (MCDA). Author found MCDA was appropriate for selection of project delivery system. In his paper, results of research were presented that develop numerical data \_quantitative metrics\_ called relative effectiveness values from qualitative variables considered in selecting project delivery systems. With the relative effectiveness values, a multi criteria decision analysis methodology can be implemented to quantitatively compare alternative delivery systems and analytically identify an optimal solution for any given project.<sup>[5]</sup>
- **Fereshteh Mafakheri et al.** carried out study in his paper titled ‘ Project Delivery System Selection under Uncertainty: Multi-criteria Multilevel Decision Aid Model’. This study is intended to select an optimal project delivery system to ensure project success. In his research, a decision aid model using the analytical hierarchy process (AHP) coupled with rough approximation concepts was developed to assist the owners. The selection criteria were determined by studying a number of benchmarks. The model ranks the alternative delivery systems by considering both benchmark results and owner’s opinion. In interval AHP, an optimization procedure is performed via obtaining the upper and the lower linear programming models to determine the interval priorities for alternative project delivery systems. In cases having incomparable alternatives, which are the most likely case in uncertain decision making, the model uses rough set-based measures to reduce the number of decision criteria to a subset, which is able to fully rank the alternatives. The author concludes that the model was able to effectively facilitate the decision-making process.<sup>[6]</sup>
- **Fouad M. Al-Sinanetal.** presented his study in his paper on ‘Facility Project Delivery Selection Model’. The aim of this research was to find out model for project delivery system. There are different project delivery systems and the process of selecting the appropriate project delivery system according to owner's requirements is a very important

step that may significantly affect the success or failure of the project. Author developed A project delivery selection model (PDSM), and a project delivery decision model (PDDM).

- Author concluded that the model consisting of many interdependent, interrelated, and complex parameters that change with time. The PDSM model utilizes a project delivery decision model (PDDM), which consists of those parameters provided by the PDSM and a series of decision-making tools. This model will be helpful to owners for selection process.<sup>[7]</sup>

### 3. PROBLEM STATEMENT

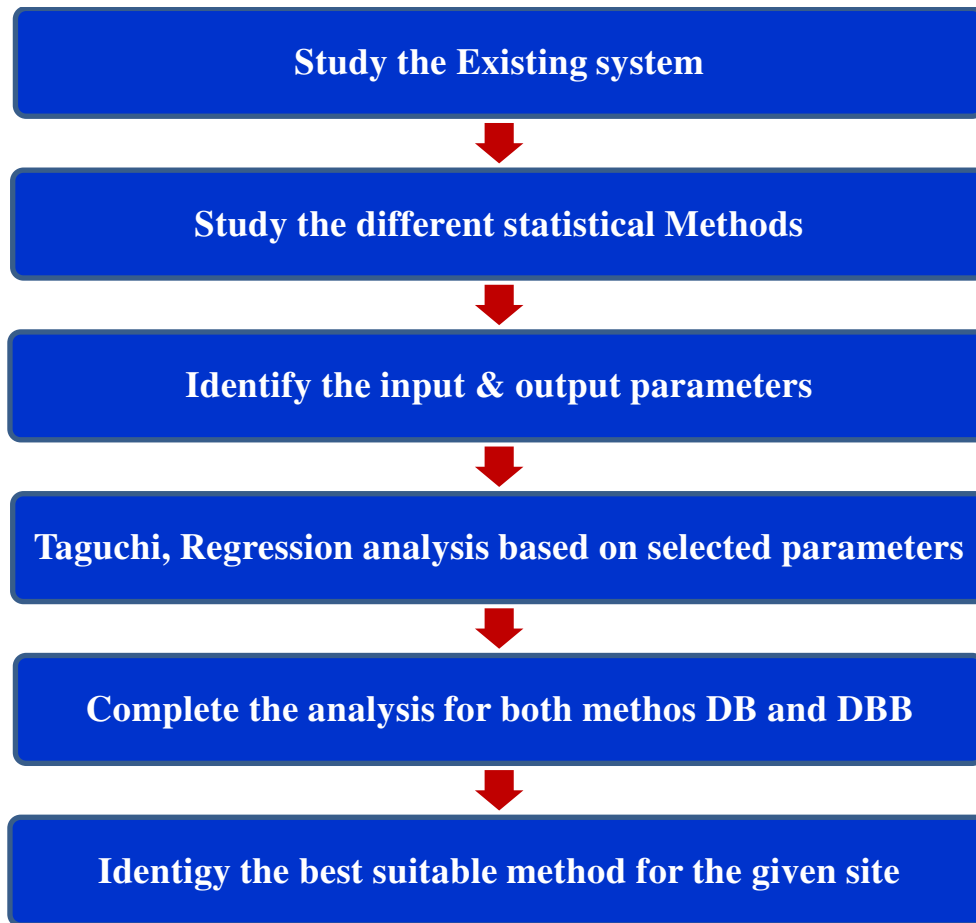
In India there is considerable growth in construction sector. Due to drastic change In Technology and material, specialization of design and construction is required. The construction industry undergoes different changes in project delivery method. These are due to customer requirements, new technology, and advanced materials. Generally construction project faced various problems like cost overruns, disputes, late delivery of material, lack of communication, poor quality. Every project owner is responsible for the implementation of a construction project and he should take important decision regarding the method by which the project will be designed and constructed i.e. the project delivery method. Decision regarding selection of project delivery method is complicated due to various parameters like cost, time, quality, and schedule. A motivation behind this study is to find out which project delivery method performs at a higher level in terms of cost, time, and quality. A different project delivery method elaborate role and responsibility of person involved in project and how owner pay for services .Contractual relations, contemporary laws and regulations, owner's perception of risks, awarding mechanisms and the method of payment all contribute to project delivery method selection. Project delivery systems offer owners choice in their search for value in infrastructure, cost, quality, service and technology.

### 4. OBJECTIVE OF THE PROJECT

Selection of appropriate project delivery method is important aspect for construction industry. It is therefore important to study the present scenario of project delivery method for construction and suggest best among them. The objectives of this project are listed as below;

- I. To study Design-Bid-Built and Design –Bid method of project delivery.
- II. To conduct the investigation to study the current scenario of project delivery method for construction.
- III. To find out which project delivery system is commonly used in Pune.
- IV. To find out significant success factor for Design Bid Build and Design Build method.
- V. To analyze the results of the investigation and compare them with the ideal requirement of a construction projects.
- VI. To suggest the feasible method for construction.

## 5. METHODOLOGY



## 6. CONCLUSION

After following the research methodology to fulfill the objectives, the following conclusions can be drawn about method of project delivery. According to analysis there is a significant difference between the performance of DBB and DB projects. In case of DB project it shows good performance with respect to fluctuation. In case of DBB project fluctuation is more. Taguchi Method and regression analysis are identified as a key methods to study DB and DBB method.

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# Determining Manufacturing Solutions For Sheet-Metal Forming Using Computational Methodology For Analysis

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<b>Keywords</b>	HyperForm, Manufacturing Solutions, Forming Die, Development Time, Wrinkles, Tearing, Springback				

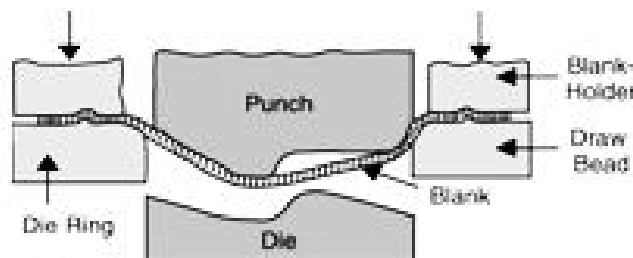
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## Abstract

*This dissertation work shall focus on deployment of computational tools and techniques to evolve manufacturing solutions. The challenge posed by the 'Form' and/or the 'Draw' operation in terms of wrinkling , tearing, thinning and/ or spring back has a pronounced effect on the development cycle time and the quality of the part or the product. It could have adverse consequences relating to the function of the part and/or the aesthetic aspect for visual appeal to the customer. Hyperworks suite from 'Altair' could be utilized in analyzing the problem. This would help the Engineer in arriving at alternative solutions for the problems at hand. Mathematical treatment shall be offered for finding the tonnage required to carry out the operation, while the analysis shall be conducted using 'HyperForm' to predict the nature of effects to be addressed in the tryout phase. Experimentation at the press shop shall be done to validate the solution determined during the research work.*

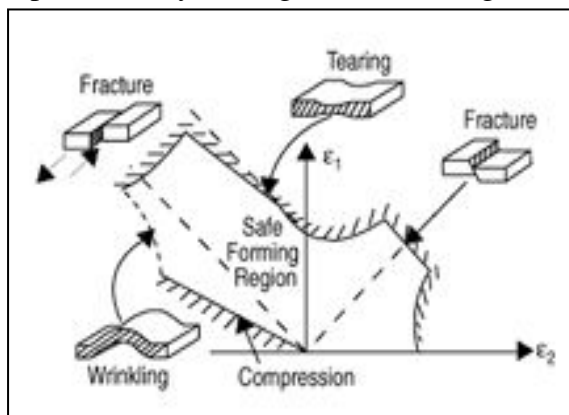
## 1. INTRODUCTION

In stamping, drawing, or pressing, a sheet is clamped around the edge and formed into a cavity by a punch. The metal is stretched by membrane forces so that it conforms to the shape of the tools. The membrane stresses in the sheet far exceed the contact stresses between the tools and the sheet, and the through-thickness stresses may be neglected except at small tool radii. Figure 1 shows a stamping die with a lower counter-punch or bottoming die, but contact with the sheet at the bottom of the stroke will be on one side only, between the sheet and the punch or between the die and the sheet. The edge or flange is not usually held rigidly, but is allowed to move inward in a controlled fashion. The tension must be sufficient to prevent wrinkling, but not enough to cause splitting.

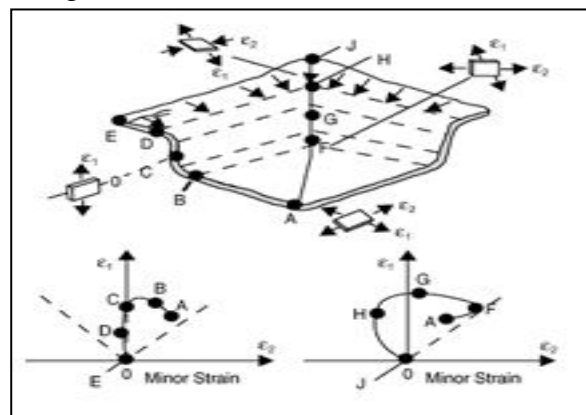


**Figure 1: A schematic section of a typical stamping die**

The limits of deformation, or the window for stamping, are shown in Figure 2. It is assumed that the failure limits are a property of the sheet. This assumption is reasonable if through-thickness stresses are negligible, and if each element follows a simple, linear path represented by a straight line radiating from the origin.



**Figure 2: A schematic plot of the window of safe straining for simple paths the FLD**



**Figure 3: Strain signature along lines A to J & A to E in a rectangular pan**

The path in stampings is described by the ratio of the membrane strains

$$b = e_2/e_1$$

which vary from equal biaxial stretching ( $b = 1$ ) to uniaxial compression ( $b = -2$ .) Figure 3 shows the strain paths along two lines in a rectangular pressing. Such diagrams are strain signatures of the part. Unequal biaxial stretching ( $b \neq 1$ ) will occur in the middle, A. In the sidewall, C, plane strain is most likely. If the side of the stamping is long and straight, plane

strain will exist also at D. Over the rounded corner of the punch at F, the strain is biaxial. From H to J, strains are in the tension-compression quadrant. The concept of the forming limit curve is that all possible strain signatures are bounded by an envelope that is a characteristic only of the material. The origins of this failure map were reviewed earlier, and more recent developments are described here.

## 2. LITERATURE REVIEW

1. A particle finite element method for analysis of industrial forming Processes by, **Eugenio Onate, Alessandro Franci**, studied about Lagrangian formulation for analysis of industrial forming processes involving thermally coupled interactions between deformable continua. The governing equations for the deformable bodies are written in a unified manner that holds both for fluids and solids. The success of the formulation lays on a residual based expression of the mass conservation equation obtained using the finite calculus method that provides the necessary stability for quasi/fully incompressible situations. The governing equations are discretized with the FEM via a mixed formulation using simplified elements with equal linear interpolation for the velocities, the pressure and the temperature. The merits of the formulation are demonstrated in the solution of 2D and 3D thermally-coupled forming processes using the particle finite element method.

2. **Seong-Chan Heo & Young-Ho Seo** studied on thick plate forming using flexible forming process and its application to a simply curved plate. Flexible forming machine are carried out for the purpose of manufacturing a prototype of curved plate block for hull structure used in shipbuilding industry. Flexible forming dies which consist of numbers of punches in an array form for upper and lower sides are designed in view of thick plate forming. A punch has formation of male and female screws to adjust its length with regard to a given surface, and all punches are supported by each other in punch housing.

3. **Giovanni B. Broggiato** studied the Computer-aided engineering for sheet metal forming: definition of a spring back quality function. Computer-aided engineering methods are extensively applied to sheet metal forming integrated design. The adoption of a new class of materials, the advanced high strength steels, has increased the occurrence of springback, and consequently the request for tools oriented to spring back reduction and optimization. This paper presents an approximated formulation to compute the spring back field after stamping through the finite element analysis of the process. This can be found assuming that the residual field of nodal forces after stamping produces a spring back shape referable to a linear combination of  $n$  modes of vibration of the nominal shape of the component. The aim of this formulation is not that of substituting the finite element analysis of the spring back but rather to make use of the coefficients of the linear combination, so to define a global quality function for spring back. In this way, Robust Design methods or other current optimization procedures to improve the stamping process as for structural defects (such wrinkling, necking and flatness) can be applied also for the reduction of spring back. The meaning of these coefficients will be shown through three test cases and the consistency of

the formulation will be discussed according to the number of modes of vibration included in the computation.

**4. D. Y. KIM et al** studied the Life estimation of hot press forming die by using Interface heat transfer coefficient obtained from Inverse analysis. During the hot press forming process, the die experiences repeated thermal and mechanical loads owing to exposure to the heated workpiece. Such repeated thermal loads may cause deterioration in the mechanical properties of the die, leading to fatigue failure. Therefore, for the successful implementation of the hot press forming process in mass production, it is necessary to estimate the die life under hot press forming conditions. The fatigue life of a hot press forming die is estimated based on the stress history of the die during the forming process. Because accurate understanding of thermal behavior is essential for reliable analysis of fatigue life of the die at elevated temperatures, we characterized the thermal boundary condition, i.e., the heat transfer coefficient at the die-workpiece interface. For this purpose, die temperatures during a hot press forming process were measured as a function of time at select locations on the die. Inverse finite element method (FEM) analysis of the hot press forming process was performed to determine the interface heat transfer coefficient. The interface heat transfer coefficient was applied to the FEM simulation, and the temperature distribution and stress values for the die were determined. Considering the thermo-mechanical stress history, the fatigue life of the die was estimated based on the stress-life approach.

**5. Seong-Chan Heo & Jae-Nam Kim** studied the Shape error compensation in flexible forming process using over bending surface method. In this article, the design of the flexible forming process considering die shape compensation using an iterative over bending method based on numerical simulation is carried out. In this method, the spring back shape obtained from the final step of the first forming simulation is compared with the desired objective shape, and the shape error is calculated as a vector norm with three-dimensional coordinates. The error vector is inversely added to the objective surface to compensate both the upper and lower flexible die configuration. The flexible dies are made up of several punches that make a forming die that is equivalent to a solid die, thus the forming surface shape can be reconfigurable with regard to the compensated die shapes.

### 3. PROBLEM DEFINITION

The Tool-Die making ancillary industry need to cope up with unique problems during the Design as well as Process Engineering phase. The Engineer has to deal with quality related Design issues which finally have a bearing on the try-out and the Manufacturing phase of the development cycle. Anticipation during the Design and Development phase can reduce total development time and consequently save costs towards rejections. The typical problems encountered while dealing with the Forming or Draw operation can be listed as:

- i. Presence of 'Wrinkles' around the periphery of the semi-finished or finished part
- ii. 'Tearing' observed especially around sections subjected to non-uniform strain due to uneven material flow (usually restricted by relatively sharp edges).



- iii. Thinning observed in local regions that may be unacceptable for 'function' or could lead to 'tearing' further.
- iv. Springback- Tendency to regain original (unformed) dimensions causing distortions or deviations from the given size or the included angle.

#### 4. SCOPE AND OBJECTIVE:

- i. Study the existing component function and its specifications.
- ii. calculate the tonnage calculation for the given component
- iii. Selection of other components in the die based on tonnage
- iv. Forming analysis and results interpretation using Altair Suite.
- v. Find out the alternatives to minimize the component defects.
- vi. Validation through experimentation

#### 5. METHODOLOGY

##### I. Mathematical calculations:

In mathematical calculations, tonnage calculation for the component will be completed using standard formulae. Based on these calculations other part selection will be completed.

##### II. Computational analysis

In computational method, defects would be predicted using Hyperworks Suit. There are three main steps, pre-processing, processing, post-processing. Blank holding force calculated using mathematical method, would be used for analysis.

- **Pre-processing:** Die-punch setup would be prepared using Hyperform interface. Meshing, material property assigning, applying load and boundary condition are the steps in pre-processing.
- **Processing:** The input file exported to RADIOSS software.
- **Post-processing:** For post-processing, HyperView interface used for interpretation of results. Results would be studied in contour format. Thinning, wrinkles, FLD, these plots are studied.

#### 6. EXPERIMENTATION

Experiments are to be conducted on a press of a suitable type and capacity. The die would be mounted on the bolster plate of the press and the speed of the ram would be set based on the historical data as well as the input received from the analysis data (simulation).

Forming problems can be predicted before tool fabrication through the use of software that can be integrated into production routes which rely increasingly on computer technology. The prediction of forming difficulties at the component design stage ensures that the chosen geometry is compatible with the formability of steel. Forming has become a highly technical process, and the development of a steel forming route no longer involves simple trial and error methods. Close collaboration between component designers, forming engineers and

steelmakers guarantees the industrial feasibility of new parts with very short development times.

The parameters influencing the form operation as evident during the trials are:

- Type of material
- Thickness of the component
- Mechanical properties, especially the Limiting Draw Ratio
- Use of lubricant
- Blank size and development
- Blank holding pressure
- Speed of the operation

For this work, the critical parameter/s (one or two) shall be identified and modified to realize a desired response.

## 7. VALIDATION

The appropriate capacity press can be selected by knowing the forming load. Working with the presses of higher capacities may lead to many types of defects such as cracks and tearing. Blank holder pressure needs to optimize over a given range for optimized geometry. The coefficient of friction needs to be optimized for the new geometry. The actual trials performed over the component would directly reflect over the ease of 'Forming operation' realized for the said Die design.

## 8. CONCLUSION

The sheet metal forming operation poses challenges for defects including Tearing, Wrinkles, Spring-back, Thinning, etc. Use of Finite Element Modeling can help to reduce the development time for trials and the associated costs for the project. Use of Altair HyperForm as a CAE tool is predominant in the industry for simulating the process and predicting the defects. This work shall primarily include F.E. Modeling techniques for finding alternative solutions. Trials and testing shall be considered towards the concluding phase of the project work for validating the solution proposed during Analytical phase of the work.

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# Correlation Between Academic Problems Faced By Standard XI Students And Educational Qualification Of Parents

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Subject Area

Education

Keywords

Academic Problems, Urban Students, Educational Qualification of parents

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## Abstract

*An investigation was made to find out whether there is any significant correlation between academic problems faced by Standard XI students and Educational Qualification of their parents. In the present study, random sampling technique was adopted to select a sample of 300 students of standard XI in Ramanathapuram Educational district, and self made tool was used to collect data. The result revealed that there is no significant correlation between academic problems faced by male, female and rural students and Educational Qualification of their parents. But there is significant correlation between academic problems faced by urban students and Educational Qualification of their parents.*

## 1. INTRODUCTION

As political, social and economic conditions change and new problems arise it becomes accessory to re-examine carefully and restate clearly the objectives which education at each definite stage should keep in view more over this statement must take into account not only the facts of the existing situation, but also the direction of its development and the nature and the type of the social order that we envisage for the future to which education has to be geared. Problems are regarding parent's high aspiration regarding achievement of their sons and daughters and when they do not come up to their aspiration, there is constant quarrelling among parents and adolescent. Sometimes these quarrels result in dire consequences. Adolescent runs from his home and may commit suicide.



There is lack of understanding between parents and adolescents regarding freedom and money. The parents treat adolescent like a child. They never discuss problems freely with them.

## 2. NEED AND SIGNIFICANCE OF THE STUDY

- I. **Problems of adolescence:** Adolescence is a period of transition from childhood to maturity. Hall has called this period a period of storm and stress. Adolescents have many problems and these mainly centre round the following:
- II. **Home:** In adolescence the child is reminded now and then about his duty and responsibility by the adult members of the family. They place upon him new demands. This confuses him and he fails to meet these demands. The parents have high expectation from the adolescents, but when they are not fulfilled, constant quarrelling occurs among parents and adolescents. This may result in truancy from home or, in extreme case, suicide.
- III. **School:** Most of the adolescents face a great problem to adjust with the rigid time table and syllabus. There is hardly any scope for extracurricular activities in schools. Teachers are rigid and unsympathetic. Examination, pass-fail system and parent's aspiration are sources of worry to the adolescents. When the child fail to adjust with the rigid school system, either he becomes neurotic or becomes delinquent.
- IV. **Society:** Adolescents are expected to behave like an adult in a society. They must learn social customs and manners. When they fail to obey the dictate of the adult members of the society, they are ridiculed. They have no freedom to act according of their conscience. All these result in severe mental conflicts in adolescents.
- V. **Vocational Problems:** The child starts thinking of his future career when he reaches adolescence. He needs money for various activities he follows. But he feels as harmed of begging money from the adults. Parents are not always willing to provide money for his frivolous pursuits. Under such circumstances, he craves for an occupation which will give him money, but how shall he get occupation when thousands of unemployed adolescents are roaming the street. This thought of uncertain future haunts the mind of the adolescents.

## 3. STATEMENT OF THE PROBLEM

“Correlation between Academic Problems faced by Standard XI students and Educational Qualification of Parents”.

## 4. DEFINITION OF THE TERMS

- **Academic Problems:** Problems refer to a situation requiring a solution. In psychological terms, a problem is a hindrance that disrupts the continuity of process within the individual or in a group. By academic problems, the investigator means problems connected with academic work and school work.

- **Educational Qualification:** Educational qualification of an individual is determined by the certificate or diploma or Degree bestowed on him by way of completing successfully an academic course or training.

## 5. OBJECTIVES OF THE STUDY

- I. To find the significance of correlation between academic problems faced by the boys and Educational Qualification of parents.
- II. To find the significance of correlation between academic problems faced by girls and Educational Qualification of parents.
- III. To find the significance of correlation between academic problems faced by rural students and Educational Qualification of parents.
- IV. To find the significance of correlation between academic problems faced by urban students and Educational Qualification of parents.

## 6. NULL HYPOTHESES

- I. There is no significant correlation between academic problems faced by boys and Educational Qualification of parents.
- II. There is no significant correlation between academic problems faced by girls and Educational Qualification of parents.
- III. There is no significant correlation between academic problems faced by rural students and Educational Qualification of parents.
- IV. There is no significant correlation between academic problems faced by urban students and Educational Qualification of parents.

## 7. METHODOLOGY ADOPTED FOR THE PRESENT STUDY

To investigate and to determine the status of a present phenomenon the survey method is the best.

- I. **Population for the study:** The population of the present study is the students of standard XI in Ramanathapuram Educational district.
- II. **Sample for the study:** In the present study random sampling technique was adopted to select a sample of 300 students of standard XI in Ramanathapuram Educational district.

## 8. TOOLS USED

The investigator used self-made questionnaire to collect data from the students. The first part of the questionnaire - Bio-data is for the personal information. They are,

- Gender
- Place of residence
- Locality of school
- Type of management
- Nature of school

- Medium of instruction
- Parental Educational Qualification
- Family Annual Income

The second part of the questionnaire consists of 40 statements. Each statement consists of three responses. The 3-point scale (yes / undecided / no) is used. There are negative statements and positive statements in the questionnaire.

### i. SCORING KEY

Table – 1: Scoring done for positive statements

S. No	Responses	Score
1.	Yes	1
2.	Undecided	2
3.	No	3

Table – 2: Scoring done for negative statements

S. No	Responses	Score
1.	Yes	3
2.	Undecided	2
3.	No	1

Table – 3: The total number of positive and negative statements

Nature Of Items	Items Numbers	No. Of Items
Positive	1,2,3,4,5,6,8,9,10,11,12,17,21,25,27,30, 35, 36,37,39,40	21
Negative	7,13,14,15,16,18,19,20,22,23,24,26,28, 29,31,32,33,34,38	19

### ii. DIMENSION

The problems of students were measured under dimension such as

- Personal
- School
- Social
- Home

## 9. ANALYSIS OF DATA

**I. NULL HYPOTHESIS:** There is no significant correlation between academic problems faced by boys and educational qualification of parents

**Table – 4: Correlation between academic problems faced by boys and educational qualification of parents**

Gender	Parental Educational Qualification $\sum X$	Academic Problems $\sum Y$	$\sum X^2$	$\sum Y^2$	$\sum XY$	Correlation Co-Efficient	Significance Of Correlation Co - Efficient
Male	1028	25612	4880	2727610	108072	0.036	No Significant

It is inferred that the table value 0.113 is greater than the calculated correlation co-efficient 0.036. Therefore, there is no significant correlation between academic problems faced by boys and educational qualification of parents.

**II. NULL HYPOTHESIS:** There is no significant correlation between academic problems faced by girls and educational qualification of parents.

**Table – 5: Correlation between academic problems faced by girls and educational qualification of parents**

Gender	Parental Educational Qualification X	Academic Problems Y	$\sum X^2$	$\sum Y^2$	$\sum XY$	Correlation Co-efficient	Significance of correlation co - efficient
Female	882	22024	4152	2309478	91323	0.031	No significant

It is inferred that the table value 0.113 is greater than the calculated correlation co-efficient 0.031. Therefore, there is no significant correlation between academic problems faced by girls and educational qualification of parents.

**III. NULL HYPOTHESIS:** There is no significant correlation between academic problems faced by rural students and educational qualification of parents.

**Table – 6: correlation between academic problems faced by rural students and educational qualification of parents**

Locality of School	Parental Educational Qualification $\sum X$	Academic Problems $\sum Y$	$\sum X^2$	$\sum Y^2$	$\sum XY$	Correlation Co-efficient	Significance of correlation co - efficient
Rural	740	18531	3522	1976059	78081	0.052	No significant

It is inferred that the table value 0.113 is greater than the calculated correlation co-efficient 0.052. Therefore, there is no significant correlation between academic problems faced by rural students and educational qualification of parents.

**IV. NULL HYPOTHESIS:** There is no signification correlation between academic problems faced by urban Students and educational qualification of parents.

**Table - 7: Correlation between academic problems faced by urban Students and educational qualification of parents**



Locality of School	Parental Educational Qualification $\sum X$	Academic Problems $\sum Y$	$\sum X^2$	$\sum Y^2$	$\sum XY$	Correlation Co-efficient	Significance of correlation co-efficient
Urban	72	1350	434	141316	7510	0.166	Significant

It is inferred that the table value is 0.113 is less than the calculated correlation co-efficient 0.166. Therefore, there is significant correlation between academic problems faced by urban Students and educational qualification of parents.

## 10. FINDINGS

- There is no significant correlation between academic problems faced by boys and educational qualification of parents.
- There is no significant correlation between academic problems faced by girls and educational qualification of parents.
- There is no significant correlation between academic problems faced by rural students and educational qualification of parents.
- There is significant correlation between academic problems faced by urban students and educational qualification of parents.

## 11.DISCUSSION

The recent social structure, social expectations and the available means of attaining upward mobility extend directly and indirectly pressure on the parents who desire their children to be educated. This pressure is so commonly existent that its impact on the parents and their motivation to get their children educated is far beyond the limits of the gender of their children. Hence the academic problems faced by standard XI students can be attributed to the educational qualification of their parents. The fourth finding reveals the crucial truth that the educational qualification of urban parents has positive significant correlation with the academic problems of their children. The urban parents have high motivation for the academic progress of their children and they have more expectation and demand on the higher achievement of their children. Hence the higher the qualification the more the academic problems faced by their children due to the pressure exerted by their parents.

## 12. RECOMMENDATIONS

- Parents should be made aware of child psychology. It will help them in understanding their children.
- Parents should be tried to provide needed facilities for their children to study at home. The parent's highest priority must be their children.
- Parents should inform their wards about their financial conditions and to make them realize the reality of their positions.

- iv. In order to decrease the academic problems of rural school students, they may be provided with opportunities to improve their study.
- v. Students should be given adequate freedom to respond in the class.
- vi. Development of achievement is affected by number of variable in home. Parental expectation and guidance to the child develop need for high achievement in life.
- vii. In home, create a warm, friendly atmosphere where smiles a bound.
- viii. Students can be encouraged for group discussion, learning with the peer group to develop healthy emotional traits.
- ix. Parents should make the child self-responsible by educating them the skill of solving problems.

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# An Analytical Study To Identify The Leadership Position In Profit With Reference To Selected Public Sector Banks

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## Abstract

*The study entitled as an analytical study to identify the leadership position in profit with reference to selected public sector banks based on their past three years financial performance is carried out with the basic objectives as study about banking functions and analyze their financial performance. The importance of profit is defined to be Profitability is the ability of a business to earn a profit. A profit is what is left of the revenue a business generates after it pays all expenses directly related to the generation of the revenue, such as producing a product, and other expenses related to the conduct of the business activities. For this research, public sector banks such as State Bank of India, Indian Overseas Bank, Indian Bank, Central bank of India and Bank of India financial statements were used secondary alone. Financial tools such as ratio analysis like gross profit ratio, net profit ratio, operating profit ratio, Return on Investment ratio, Return on asset ratio, Capital employed ratio were used for data analysis and interpretation.*

## 1. INTRODUCTION

The word 'profitability' is composed of two words, namely; profit and ability. The term profit has already been discussed at length in detail. The term ability indicates the power of a firm to earn profits. The ability of an enterprise also denotes its earning power or operating performance. Also, that the business ability points towards the financial and operational

ability of the business. So, on this basis profitability may be defined as —the ability of a given instrument to earn a return from its use”. *Weston and Brigham* define profitability as "the net surplus of a large number of policies and decisions. Profit being an absolute figure fails to indicate the adequacy of income or changes in efficiency resulting from financial and operational performance of an enterprise. Much difficulty and confusion comes home while interpreting the absolute figures of profit in case of historical or inter-firm comparisons due to variation in the size of investment or volume of sales etc. Such problems are handled by relating figures of profit either with the volume of sales or with the level of investment. A quantitative relationship is thereof established either in the form of ratios or percentages. Such ratios are names as profitability ratios. Thus, profitability may be regarded as a relative term measurable in terms of profit and its relation with other elements that can directly influence the profit. Profit is the positive gain remaining for a business after all costs and expenses have been deducted from total sales. Profit is also referred to as the bottom line, net profit or net earnings.

### 1.1 Profitability Analysis Indicator

- ▶ **Effective Tax Rate:** A company's tax rate which is calculated by comparing its income tax expense to its pretax income. This amount will often differ from the company's stated jurisdictional rate due to many accounting factors, including foreign exchange provisions. This effective tax rate gives a good understanding of the tax rate the company faces.
- ▶ **Profit Margin Analysis:** In the income statement, there are four levels of profit or profit margins - gross profit, operating profit, pretax profit and net profit. The term "margin" can apply to the absolute number for a given profit level and/or the number as a percentage of net sales/revenues. Profit margin analysis uses the percentage calculation to provide a comprehensive measure of a company's profitability on a historical basis (3-5 years) and in comparison to peer companies and industry benchmarks.
- ▶ **Return On Assets:** The return on assets (ROA) ratio illustrates how well management is employing the company's total assets to make a profit. The higher the return, the more efficient management is in utilizing its asset base. The ROA ratio is calculated by comparing net income to average total assets, and is expressed as a percentage.
- ▶ **Return On Capital Employed:** The return on capital employed (ROCE) ratio, expressed as a percentage, complements the return on equity (ROE) ratio by adding a company's debt liabilities, or funded debt, to equity to reflect a company's total "capital employed". This measure narrows the focus to gain a better understanding of a company's ability to generate returns from its available capital base. The return on capital employed is an important measure of a company's profitability. Many investment analysts think that factoring debt into a company's total capital provides a more comprehensive evaluation of how well management is using the debt and equity it has at its disposal. Investors would be well served by focusing on ROCE as a key, if not the key, factor to gauge a company's profitability. An ROCE ratio, as a very general rule of thumb, should be at or above a company's average borrowing rate. Unfortunately, there are a number of similar ratios to ROCE, as defined herein, that are similar in nature but calculated differently, resulting in



dissimilar results. First, the acronym ROCE is sometimes used to identify return on common equity, which can be confusing because that relationship is best known as the return on equity or ROE. Second, the concept behind the terms return on invested capital (ROIC) and return on investment (ROI) portends to represent "invested capital" as the source for supporting a company's assets. However, there is no consistency to what components are included in the formula for invested capital, and it is a measurement that is not commonly used in investment research reporting.

- ▶ **The return on equity ratio:** The return on equity ratio (ROE) measures how much the shareholders earned for their investment in the company. The higher the ratio percentage, the more efficient management is in utilizing its equity base and the better return is to investors. The ROE ratio is an important measure of a company's earnings performance. The ROE tells common shareholders how effectively their money is being employed. Peer Company, industry and overall market comparisons are appropriate; however, it should be recognized that there are variations in ROEs among some types of businesses. While highly regarded as a profitability indicator; the ROE metric does have a recognized weakness. Investors need to be aware that a disproportionate amount of debt in a company's capital structure would translate into a smaller equity base. Thus, a small amount of net income (the numerator) could still produce a high ROE off a modest equity base (the denominator).

### **1.2 Concept Of Profitability:**

- ▶ **Accounting Profitability:** Profitability is a measure of evaluating the overall efficiency of the business. The best possible course for evaluation of business efficiency may be input-output analysis. Profitability can be measured by relating output as a proportion of input or matching it with the results of other firms of the same industry or results attained in the different periods of operations. Profitability of a firm can be evaluated by comparing the amount of capital employed i.e. the input with income earned i.e. the output. This is popularly known as return on investment or return on capital employed. It is regarded as the overall profitability ratio and has two components; net profit ratio and turnover ratio. accepted as an indicator of performance and capability. This is the reason for viewing operational and financial performance in relation to the scale of resources of funds required in production. That is, "a given amount of profit return should be evaluated in terms of the percentage profit return on the investment of funds." Moreover, "the return on capital used depicts the effectiveness of all the operating decisions from the routine to the critical, made by the management at all levels of the organization from shop foreman to President.
- ▶ **Social Profitability:** Along with the economic objective of earning profits, a business is also required to perform a large number of social objectives. Besides providing better quality of goods and services, it provides big employment opportunities to the people, better condition of work, fulfill community needs, conserves resources etc.
- ▶ **Value Added Profitability:** Wealth generation is essential for every enterprise. Value added profitability indicates the wealth generated (net value earned) as a result of manufacturing process during a specified period. Wealth generation is the very essence for survival or growth of a business. An enterprise may survive without making profit but

would cease to do so without adding value. "The enterprise, not making profit, is bound to become sick but not adding value may cause its death over a period of time." Profit forms a part of value added. Thus, value added is a broader concept. "Value added at particular level of operating capacity and claims should be determined as value added can expose the efficiency and inefficiency of a business."<sup>TM</sup> The concept of value added can be related to the concept of social profitability of an enterprise. The investment of an enterprise comprises of the investment of shareholders, debenture holders, creditors, financial institutions etc. If an enterprise fails to generate growth or add anything as value added, it would simply mean that the enterprise is misusing public funds. This concept represents the wealth distribution in a proper manner besides suggesting how productivity can be increased when reducing the consumption of resources produces same or better outputs.

- ▶▶ **Measurement of Profitability:** The measurement of profitability for a concern is as important as the earning of profits. The importance of measuring profitability has been stated by Hingorani, Ramanathan and Grewal, "A measure of profitability is the overall measure of efficiency."<sup>^</sup> Since, profitability is the outcome of many business activities. Therefore, its measurement is a multistage concept. As stated before profitability is a relative concept based on profits. But profits alone cannot express the concept of profitability. Thus, there arises a need to establish relationship between profit and other variables.

### 1.3 Purpose Of Profitability Analysis

Two forms of Profitability Analysis are supported: costing-based and account-based.

- ▶▶ **Costing-based Profitability Analysis:** Costing-based Profitability Analysis is the form of profitability analysis that groups costs and revenues according to value fields and costing-based valuation approaches, both of which you can define yourself. It guarantees you access at all times to a complete, short-term profitability report.
- ▶▶ **Account-based Profitability Analysis:** Account-based Profitability Analysis is a form of profitability analysis organized in accounts and using an account-based valuation approach. The distinguishing characteristic of this form is its use of cost and revenue elements. It provides you with a profitability report that is permanently reconciled with financial accounting.

### 1.4 Company Profile

- ▶▶ **State bank of India:** State Bank of India is an Indian multinational, public sector banking and financial services company. It is government with its headquarters in Mumbai, Maharashtra. As of 2014-15, it has assets of INR 20, 48,080 crores and 16,333 branches, including 191 foreign offices spread across 36 countries, making it the largest banking and financial services company in India by assets. State Bank of India is one of the Big Four banks of India, along with ICICI Bank, Bank of Baroda and Punjab National Bank. The bank traces its ancestry to British India, through the Imperial Bank of India, to the founding, in 1806, of the Bank of Calcutta, making it the oldest commercial bank in the Indian Subcontinent. Bank of Madras merged into the other two "presidency banks" in British India, Bank of Calcutta and Bank of Bombay, to form the Imperial Bank of India,

which in turn became the State Bank of India. Government of India owned the Imperial Bank of India in 1955, with Reserve Bank of India (India's Central Bank) taking a 60% stake, and renamed it the State Bank of India. In 2008, the government took over the stake held by the Reserve Bank of India. State Bank of India is a regional banking behemoth and has 20% market share in deposits and loans among Indian commercial banks.

- ▶ **IOB:** Indian Overseas Bank (IOB) was founded on February 10th 1937, by Shri.M.Ct.M. Chidambaram Chettyar. MCt. as he was popularly known was pioneer in many fields – Banking, Insurance and Industry. IOB was founded with the twin objectives of specializing in foreign exchange business and overseas banking. Beginning with United India Life Insurance, he ventured into general insurance in the form of United India Fire and General Insurance Company Ltd., and then the successful bank — the Indian Overseas Bank. He also set up Travancore Rayon's, India's first synthetic fiber unit, in Kerala.
- ▶ **Indian Overseas Bank (IOB):** It is a major public sector bank based in Chennai (Madras), with about 3700 domestic branches, including 1150 branches in Tamil Nadu, 3 extension counters, and eight branches and offices overseas as of 30 September 2014. Indian Overseas Bank has an ISO certified in-house Information Technology department, which has developed the software that its branches use to provide online banking to customers; the bank has achieved 100% networking status as well as 100% CBS status for its branches. IOB also has a network of about 3300 ATMs all over India. IOB has branches in Singapore, Hong Kong, Colombo, Seoul, and Bangkok. It has representative offices in Guangzhou, Vietnam, and Dubai. IOB also is part-owner of a joint-venture bank in Malaysia.
- ▶ **Indian Bank:** Indian Bank is one of the indigenous banks of India that emerged as a result of the Swadeshi Movement during the British Raj. The bank was established on 15th of August, 1907. One of the prime figures associated with the establishment of the bank was V. KrishnaswamyIyer, a lawyer from Madras (Now Chennai). The bank soon spread its wings outside India too, and opened its branch in Colombo, Sri Lanka in the year 1932 and Rangoon, Burma in 1940. The bank was further nationalized by the Government of India in the year 1969.
- ▶ **Central Bank Of India:** Central Bank of India was established in the year 1911. The bank was the vision of Sir SorabjiPochkhanawala. Out of 29 states, CBI has presence in 27 states and in 4 union territories. It has a network of 3656 branches and 178 extension counters. Established in 1911, Central Bank of India was the first Indian commercial bank which was wholly owned and managed by Indians. The establishment of the Bank was the ultimate realization of the dream of Sir SorabjiPochkhanawala, founder of the Bank. Sir Pherozesha Mehta was the first Chairman of a truly 'Swadeshi Bank'. In fact, such was the extent of pride felt by Sir SorabjiPochkhanawala that he proclaimed Central Bank of India as the 'property of the nation and the country's asset'. He also added that 'Central Bank of India lives on people's faith and regards itself as the people's own bank'. In 2008 Central Bank of India entered into distribution tie up with Kodak Mahindra Asset Management Company. Under this agreement it will offer entire products of Kodak Mutual Fund products from the bank's branches. Central Bank of India has signed a Memorandum of Understanding with

WMG, an Academic Department, and University of Warwick. The MOU provides for several areas of cooperation including provision of fast-track loans for Indian students studying at WMG and the building of cooperative relationships between UK and Indian business and also the development of a low cost housing project. Among the Public Sector Banks, Central Bank of India can be truly described as an All India Bank, due to distribution of its large network in 27 out of 29 States as also in 3 out of 7 Union Territories in India. Central Bank of India holds a very prominent place among the Public Sector Banks on account of its network of 3656 branches and 178 extension counters at various centers throughout the length and breadth of the country.

- **Bank of India:** Bank of India was founded on 7th September, 1906 by a group of eminent businessmen from Mumbai. The Bank was under private ownership and control till July 1969 when it was nationalized along with 13 other banks. Presently Bank has overseas presence in 22 foreign countries spread over 5 continents – with 60 offices including 5 Subsidiaries, 5 Representative Offices and 1 Joint Venture, at key banking and financial centers viz., Tokyo, Singapore, Hong Kong, London, Jersey, Paris and New York.

## 2. REVIEW OF LITERATURE

**Krishna (1996)** in his article titled, “Profitability Analysis: An Overview”, has defined the profitability analysis in detail. According to the researcher, it is a rate expressing profit as a percentage of total aspects or sales or any other variable to represent assets or sales. What should be used in the numerator and the denominator to compute the profit rate depends upon the objective for which it is being measured. Profit margin ratios measures company performance.

**Kewaljeet (1999)** in his article, “Profitability Performance of Nationalised Banks: Some Issues”, made an attempt to analyze the profitability performance of State Bank of Patiala keeping in mind the changing economic reward. According to the author, percentage in growth in gross income after the reform process started in 1991-92 decreased from a growth of 201.92 per cent during 1985-86 to 1989-90 to a growth of 74.80 per cent during 1990-91 to 1994-95 (the period of liberalization). As a result of liberalization, there is continuous decline in the profits of commercial banks.

**Singh R (2003)**, in his paper Profitability management in banks under deregulate environment, IBA bulletin, No25, has analyzed profitability management of banks under the deregulated environment with some financial parameters of the major four bank groups i.e. public sector banks, old private sector banks, new private sector banks and foreign banks, profitability has declined in the deregulated environment. He emphasized to make the banking sector competitive in the deregulated environment. They should prefer noninterest income sources.

**Asha (1987)** of reserve bank of India had worked out the required norms and techniques for evaluating the performance of public sectors banks. She has reinvented the different techniques adopted by different agencies and criteria for evaluating the banking performance. Such as margin ratios, return on investment. The empirical findings of her



study shows a positive trend in terms of opening new branches deposits mobilization and advances over a period.

### 3. RESEARCH METHODOLOGY

#### 3.1 Research Designs

Research design adopted for this study is analytical design in nature. Analytical design means analyzing the financial statements by using various financial tools.

#### 3.2 Objectives Of The Study

- To study the basic concept of profitability analysis.
- To know the basic functions of banks.
- To analyze the level of profitability of selected banks with their financial statements.
- To find leadership position in profitability position.
- To find and give suggestion for further improvement in profitability level of banks.

#### 3.3 Scope Of The Study

A profitability analysis is a measure of profit which is a way to measure the company performance. This company performance analyzes the company strength and weakness. The main scope for this present study is to analyze whether the firm capable to run their business or not and analysis whereto the firm has ability to pay its short and long term solvency or not.

#### 3.4 Statement Of The Problem

Profit is the primary objective and important factor for all business. All business needs a regular and consistent implement in profit to survive and prosper. And also profit is important factor for opening new branches. A business that getting continuous losses cannot survive in business and also in competitive market. So this project emphasis in analyzing five public sectors banks and finding the consistent improvement in last five dictates.

#### 3.5 Tools Used

- Gross profit margin ratio
- Net profit margin ratio
- Operating ratio
- Return of assets ratio
- Return on investment ratio
- Return on capital employee ratio

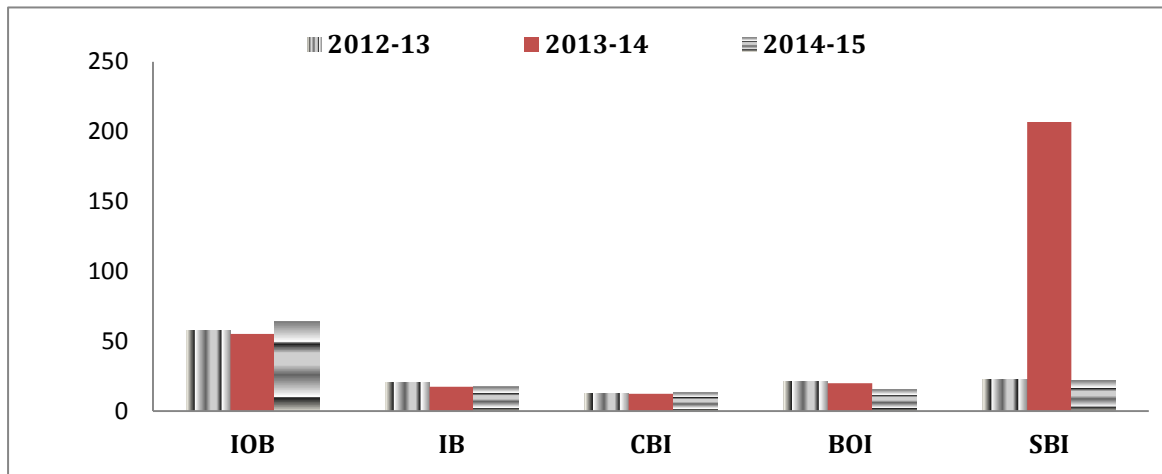
### 4. DATA ANALYSIS AND INTERPRETATION

#### 4.1 Gross Profit Ratio

Table 1: Gross Profit Ratio

Year	IOB	IB	CBI	BOI	SBI
2012-13	57.7	20.2	12.6	20.9	22.9
2013-14	55.3	17.5	12.3	20	207

2014-15	64.4	17.5	13.5	15.7	22.2
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**Figure 1: Gross Profit Ratio**

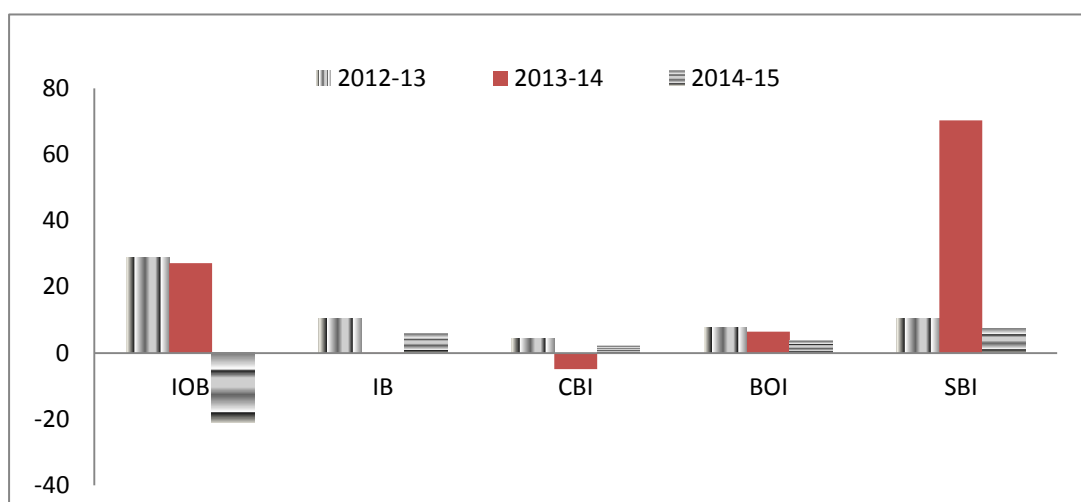
### Interpretation

From the above given table it is found to be that gross profit ratio of state bank of India was high in 2014. Central bank of India gross profit very low in all the three financial year than other banks.

### 4.2 Net Profit Ratio

**Table 2: Net Profit Ratio**

Year	IOB	IB	CBI	BOI	SBI
2012-13	28.8	10.4	4.3	7.7	10.4
2013-14	27.2	0.1	-4.8	6.5	70.3
2014-15	-21.2	5.8	2.1	3.6	7.5



**Figure 2: Net Profit Ratio**

### Interpretation:

It can be inferred from above table that net profit ratio of INDIAN OVERSEAS BANK has net loss in 2015. STATE BANK OF INDIA net profit is very high in 2014 than other public sector banks.

### 4.3 Operatating Ratio

Table 3: Operatating Ratio

Year	IOB	IB	CBI	BOI	SBI
2012-13	28.8	12	5.6	8.4	11.8
2013-14	27.2	8.9	-3.8	8.4	-12
2014-15	-21.2	8.5	3.1	3.8	12.9

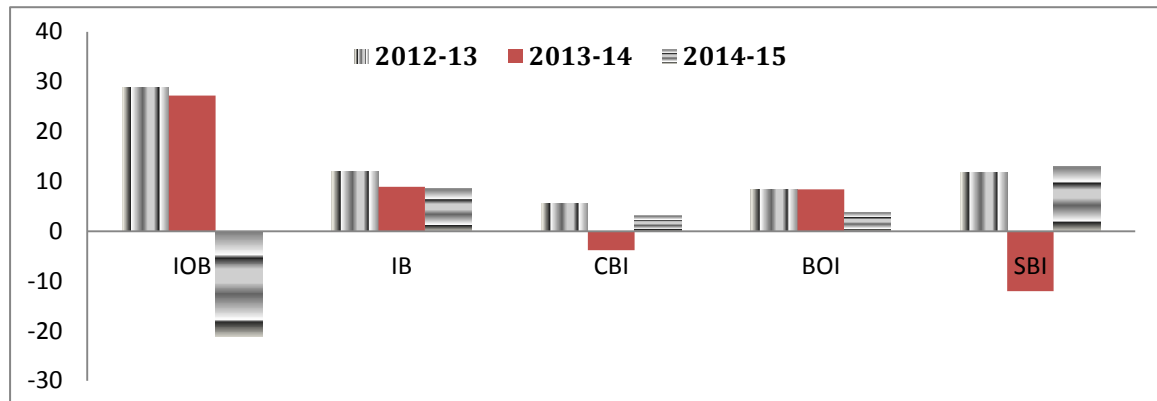


Figure 3: Operatating Ratio

#### Interpretation:

It can be inferred from above table that, in 2014-2015 Indian overseas banks has operating loss with 21.2 %. In 2013-2014 state bank of India has operating loss with 12%. But Indian bank has operating profit in last three years.

### 4.4 Return On Assets

Table 4: Return On Assets

Year	IOB	IB	CBI	BOI	SBI
2012-13	28.8	9.89	8.8	7.9	8.7
2013-14	27.2	8.98	9.2	0.1	8.6
2014-15	-21.2	9.03	9.1	7.7	8.5

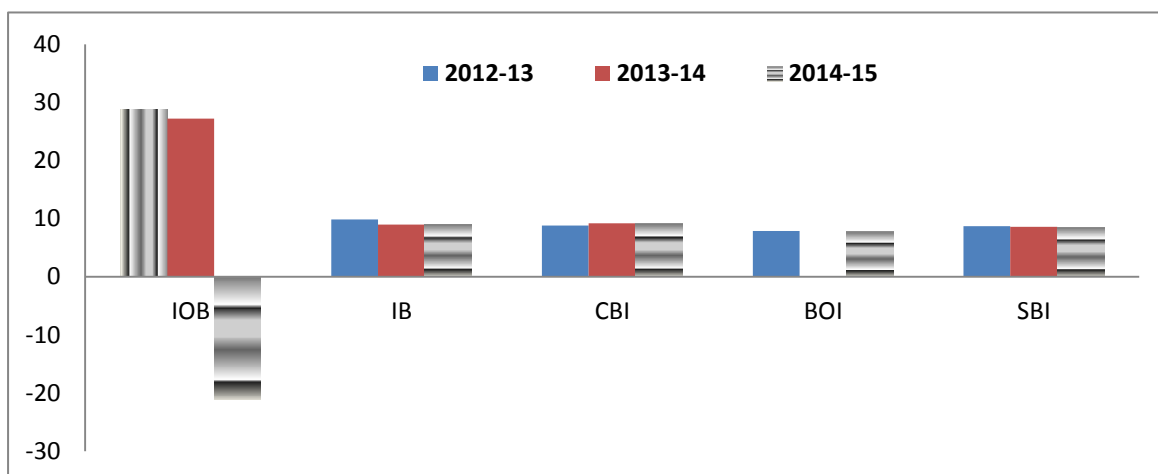


Figure 4: Return On Assets

### Interperction

From the above table it shows that, in 2014-2015 Indian overseas bank has negative return of assets. In 2012-13 and 2013-14 Indian overseas bank has high return from its assets than other banks.

### 4.5 Return On Investment

Table 5: Return On Investment ratio

Year	IOB	IB	CBI	BOI	SBI
2012-13	3.7	3.8	2.6	2.3	0.59
2013-14	2.6	3.1	2.5	2.1	0.57
2014-15	1.8	2.4	2.8	2	0.56

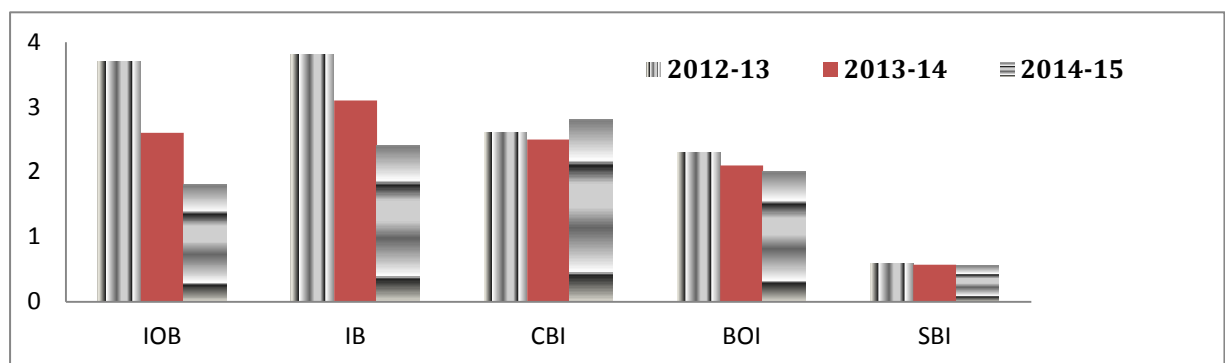


Figure 4: Return On Investment ratio

### Interperction

From the above table it is found to be that state bank of India has low return on investment than other banks in last three financial years. In 2012-2013 Indian bank has high return on investment by comparing with other banks with 3.8.

### 4.6 Return On Capital Employed Ratio

Table 6: Return On Capital Employed Ratio

Year	IOB	IB	CBI	BOI	SBI
2012-13	0.03	0.02	0.01	0.01	0.02
2013-14	0.01	0.02	0.01	0.02	0.02
2014-15	0.01	0.02	0.01	0.02	0.02

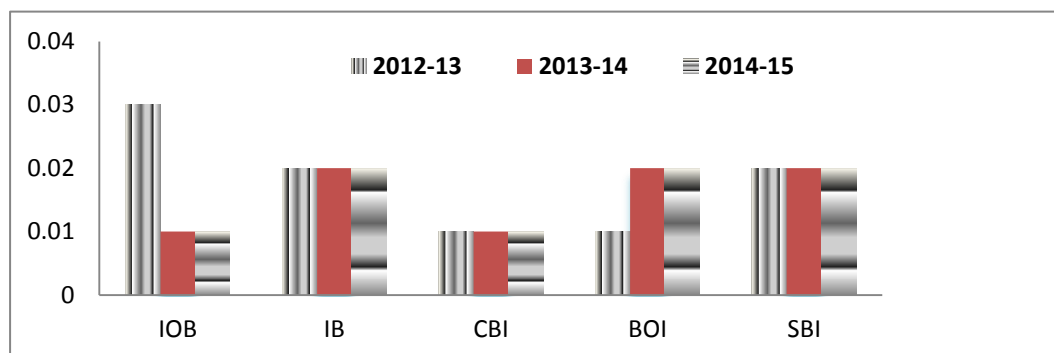


Figure 6: Return On Capital Employed Ratio



### Interpretation

Form the above table, it is interpreted that, state bank of India and Indian bank have been maintaining the same level of return on capital employed in last three decades. In 2012-2013 Indian overseas bank has high return on capital employed with .03.

### 5. Findings

- Central bank of India has high gross profit ratio in 2014-2015 financial years.
- State bank of India has high net profit in 2013-2014 financial years.
- IOB has high operating profit ratio in both 2013 and 2014 financial year than other bank.
- In 2013 and 2014 financial year Indian overseas bank has high return from its assets or investment.
- In 2012-2013 financial years IOB has high return on capital employed ratio.

### 6. Suggestion

- Gross profit ratio is the important factor for banking function without high Gross profit bank can't get net profit. Therefore central bank must concentrate and take necessary step to improve the gross profit ratio.
- Net profit is a factor which determines company strength and weakness. In terms of net profit Indian overseas bank has high gross loss so Indian overseas bank must improve the net profit by improving deposit, advances and savings of customer.
- Operating income mostly comes from ongoing operation of banking sectors. In terms of that state bank of India, central bank of India and Indian overseas bank has operating loss. So these three banks must concentrate on operating and non operating income such as generation amount from service charges, interest on loans, and interest on securities and services charges on deposit.
- A basic measure of bank profitability ascertained from return on assets. In that point of view Indian overseas bank has negative return hence Indian overseas bank must concentrate on cash and balances and opening branches at many plans.

### 7. Conclusion

In today's, competitive scenario our business strive for earning profit. Thus the way of making profit needs to be optimized. Thus the bank basic functions as circulating the money among the people by the way of saving & loan. Proper mechanism should be made in way of recovering loan & also interest rate for saving account. Though it is a service oriented sector to survive for a longer period of time & also to develop the market related activities bank should develop its profitability position further more.

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***Continuous 36<sup>th</sup> Edition, Page No: 4712-4723***

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**4723**